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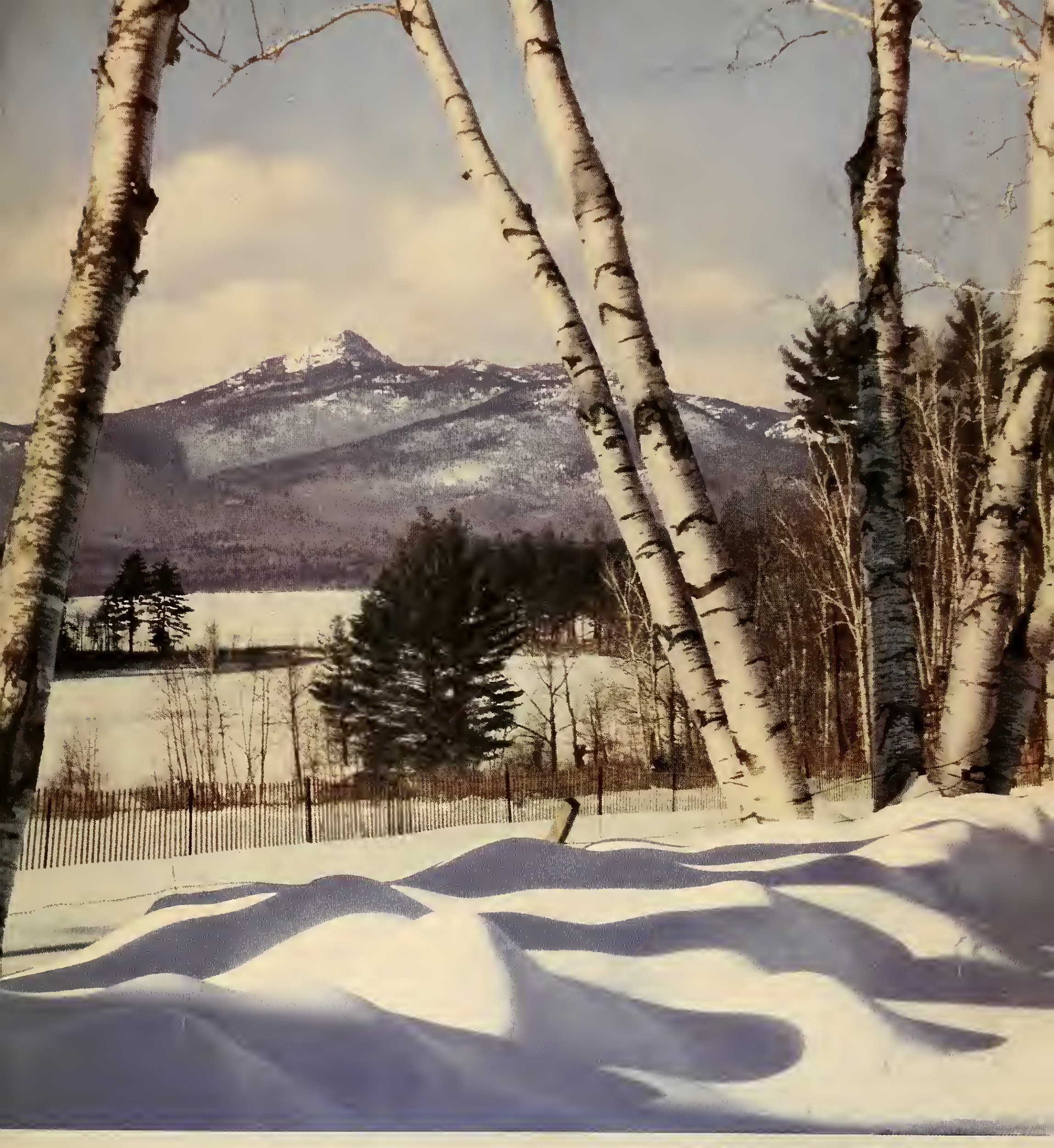

January NATURAL HISTORY *1950*

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LETTERS

Not a Knot

SIRS:

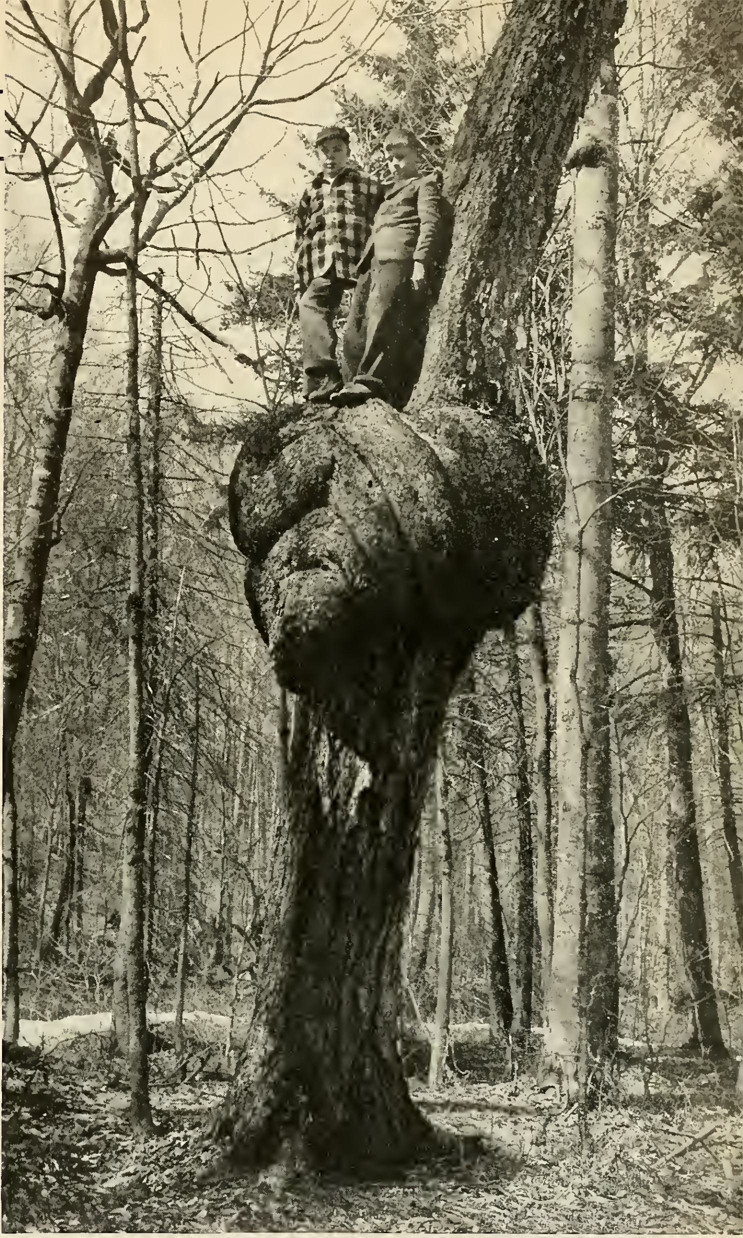
I wonder whether your readers may find as much interest as I have in this remarkable tree—a maple I believe—located in the Piseco Lake area of the Adirondack State Forest.

A friend has rendered the opinion that the tree may have been struck with an ax or other implement when it was younger and that it produced an excessive formation of bark in the effort to overcome the injury or infection that resulted. Do you concur?

GLEN DALTON.

Scotia, N. Y.

The literature indicates that galls and burls and other abnormalities are caused by various things. Some are pathological, involving bacteria and fungi; some are physiological, due possibly to nutritional disturbances; some are caused by parasitic plants (mistletoe), forming "witches brooms"; and some have been attributed to insects. It would be impossible to state what agent caused the formation shown in this photograph.—ED.



King or Gangster?

SIRS:

To Mr. McHugh, the mole may be "Little King of the Underworld" (NATURAL HISTORY, Oct., 1949), but to me and my neighbors, he is something unprintable. I have about 180 acres for moles to tunnel through, and if the "Little King" would keep out of my flower beds and front lawn—less than an acre—all would be well. But no, he won't play that way. I do not suppose Mr. McHugh would help me in my efforts to exterminate his pets or, to put it in a nicer way, confine them to their share of my property—a nice 179 acres.

There is one point I think I should make. Mr. McHugh says, "Prized daffodils are felled." Our experience down here is just the reverse. Daffodils, jonquils, and narcissus (I don't know which is generic) are grown here commercially. "The Little King" won't touch the bulbs. In fact, the way to protect a bed of fancy tulips is to plant a row of jonquils around it (cheaper than using rat wire). The mole dislikes them so much he won't go through them after tulips, which he loves. My boys insist that the mole works only on flood tide. Anything in this?

While I am at it, I might as well present another problem. Some mornings I find my lawn full of holes, two or three inches deep, as though made with a pointed stick. I blamed the ground hogs, but Henry, my outside boy, says it is brother skunk, and he has set a wire trap, baited with a piece of chicken, to catch the raider next time he goes grub hunting. Henry has had no luck to date, which suits me, for the trap is entirely too close to my bedroom window for comfort. Henry agrees to dispose of the catch in person (his stomach is much stronger than mine), but I still hope he catches a ground hog.

W. C. KING, JR.

Gloucester, Va.

NOTICE—Readers are encouraged to submit their own photographs of natural history subjects. Those selected for publication on these pages will be paid for at $3.00 each, with full credit to the photographer. Return postage must be included.

Tom McHugh, the author of "Little King of the Underworld," offers the following comments:

The distastefulness of daffodils to

moles is a very interesting point, since I have discovered no records that this creature is such an epicure. It is entirely possible, however, that the list of plants unpalatable to various animals is indeed a large one.

Even the fact that moles eat tulips is a fairly controversial subject. Examination of the stomachs of several hundred eastern moles has proved that the bulk of their diet is earthworms and white grubs. The western species of moles are quite different, however, since they consume a much greater quantity of plant material. They will readily eat tulips, bulbous irises, carrots, parsnips, and beans.

Much damage to garden greens is erroneously blamed on the mole. After our little king splits the earth into a maze of underground tunnels, he is no longer the sole owner of these galleries. Numerous other small mammals, especially shrews, meadow mice, and deer mice, find the mole's tunnels very convenient highways for traffic and for marauding. These trespassers hurt the reputation of the mole, for he is accused of much of the injury to seeds, grains, roots, and tubers that actually is done by other intruders.

A study of tooth marks on the damaged products will bear out this statement. Since the mole's short teeth are not meant for gnawing, the damaged roots are mangled rather than cut clean. Work done by rodents can be detected by the sharp tooth marks.

These intruders also bring other trouble to the mole in his supposedly safe underground castle. Voracious shrews are a constant threat to nestling young, and invading snakes may be one of the few predators of the mole.

The idea that moles work only at flood tide is quite erroneous. The earth-cleaving habits of this animal require an enormous amount of energy, which in turn depends on a gluttonous appetite. Periods of rest are abruptly ended by pains of hunger, and the mole surges forth again through the soil in a never-ending hunt for food. He has no time clock to punch and works intermittently day and night.

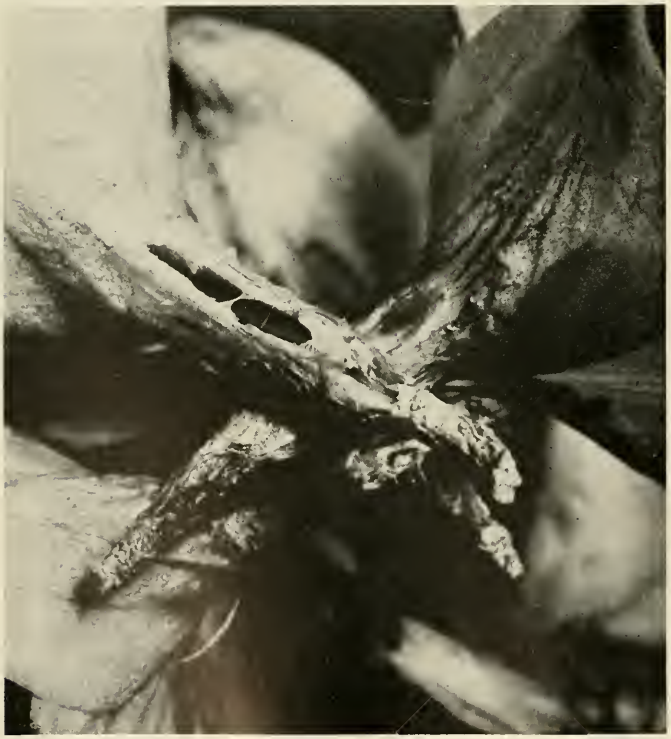
As Mr. King can prove, moles may become very annoying pests and must, therefore, be removed. Trapping is the most satisfactory method of controlling them, but it is successful only if the habits of the mole are carefully considered. Advantage can be taken of the fact that the mole is not suspicious of dirt blocking the runway. This habit provides opportunity for using a specially designed trap that straddles the runway with the trigger pan resting on the dirt blockade. As the animal travels through his tunnel and pushes through the barrier, the arms of the trap are sprung and catch him.

If hose connections are available, moles may be drowned out by flooding the runways. This works best during April, when the undeveloped young are most likely to be in the nest.

Since the mole tends to avoid obnoxious substances, repellents may be placed in runways. Lye, paradichlorobenzene, and naphthalene seem most effective. The ridges should be opened with a small stick at intervals of about ten feet. After a teaspoonful of one of these materials is inserted, close the opening carefully. Applications should be repeated whenever sections of old runways show signs of being used or when any new ridges appear.

Fencing small areas with woven wire or concrete is practicable where valuable plants require special protection. Galvanized hardware cloth with three meshes to the inch will exclude mice as well as moles. Concrete walls one inch or more thick have been found cheaper in the long run.

The holes in Mr. King's lawn are more than likely due to skunks, which like to uproot patches of sod in their search for the grubs that lie just underneath.



Bees and Pilot Whales

Sirs:

Your letter from Dr. E. P. Andrews on insects that make a short cut to the nectar in flowers reminded me of proof of such pilfering offered by photographs taken some years ago. Herbert F. Schwarz, in commenting on Dr. Andrews' letter, mentions the plant genus *Aconitum* as being the prey of a European bumblebee. Our handsome perennial larkspurs (*Delphinium*) are close relatives of the aconites, and their longer nectariferous spurs make them difficult of access to all except long-tongued insects. In my garden, bumblebees regularly chewed a short cut to the nectar supply, as this photograph (*at left*) attests. I, too, noted that honeybees often took advantage of such perforations, once opened.

The interesting article on pilot whales (September Natural History) arrived the same week that I viewed a friend's amateur movie taken of a school of "blackfish" stranded on Lieutenant's Island, near Wellfleet, Massachusetts.

An attempt was repeatedly made to "launch" smaller individuals of this stranded school. A "blackfish" would be worked into navigable water and headed seaward, but in each instance, it turned about and hopelessly rebeached itself.

More amazing was the fact that during the launching maneuvers it was found that if a bather mounted the "blackfish," it made an excellent and docile steed. Some of the best pictures in the film showed a person "cruising" through the waters of Wellfleet Bay mounted on a pilot whale! It seemed that the blowhole served a double purpose—as an invagi-

Continued on page 46

NATURAL HISTORY

The Magazine of the American Museum of Natural History

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VOLUME LIX—No. 1
JANUARY, 1950

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You will find Natural History Magazine indexed in *Readers' Guide to Periodical Literature* in your library

THE COVER THIS MONTH

Traveling by automobile along State Route 16 in New Hampshire, thousands of visitors every year pass the lovely grove of white birches that gives you a touch of winter on this month's cover. Framing a stunning view of Mt. Chocorua, these birches make one of the most photogenic foregrounds to be found anywhere in a much photographed state. Mt. Chocorua, 3475 feet high, is named for an old Indian chief of the early Pequawket Tribe. One of the more southerly of the White Mountains, it is often considered the most beautiful peak in New England.

In summertime, the deep blue of Chocorua Lake sparkles at the mountain's base. Eighteen miles to the north is the popular resort area of North Conway, and fifteen miles south is Lake Winnepesaukee. Thus, Mt. Chocorua and its birches are at the hub of a scenic vacationland.

Jack Breed caught our striking cover vista on a blustery February afternoon when the temperature was near zero. The exposure, on 5x7-inch Ektachrome daylight film, was 1/5th second at F18.

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YOUR NEW BOOKS

Margaret Mead: Male and Female • Peru

Tropical Aquariums • Indians • Poppy

FROM CAVE PAINTING TO COMIC STRIP

---------by Lancelot Hogben

Chanticleer Press, $5.00, 288 pp.
20 pp. full color, 211 black-and-white illusts.

THIS kaleidoscope of human communication is a delight both to the eye and to the mind. Ably organized and well written is this story of man's self-education by means of calendars, alphabets, number systems, mechanical and anatomical drawings, musical notation, pictures, and photographs. All this in a book of less than 300 pages would appear to be but wishful thinking, not capable of execution. However, biologist and medical statistician Hogben and visual aid expert Marie Neurath have combined their talents to achieve a high degree of success in this venture. It is the illustrations that make it possible to maintain a reasonable coherence in presenting this panorama of man's attempts to communicate with his fellows. This is no attempt to belittle the author's skill in popularization. Hogben has already established himself as an expositor of considerable effectiveness with his earlier works, *Mathematics for the Million* and *Science for the Citizen.*

Cave paintings start this story, and comic strips come in near the end, but in between is the amazing history of man's development of the various media of visual communication.

Especially pertinent is the final chapter on *The Internationalization of Free Speech.* Hogben presents a concept well worth considering. It is simply this. The complex, nervous, and suspicious world of today calls for easy, clearly understood communication between the peoples of the various nations. Some kind of international language or rather international communication is needed. It should be a medium easily learned and independent of all grammatical apparatus with the exception of word order. It should overstep the usual language barriers. Hogben suggests a picture language. When you finish this book of his you are inclined to hold with him. When he shows you how civilizations have failed when their means of communication proved inadequate, when he demonstrates how ponderous and clumsy some of these inadequate means of communication were, and when he demonstrates by some fine isotypes how clear picture language can be, you begin to get his point. Hogben feels that today we are in danger of being outstripped by the narrow advances of our specialists. The knowledge and judgment of the people must somehow catch up with our rapidly expanding and complex world of science. Hogben simply states that we might overcome this lag by means of the international language of pictures that "can be used to unite mankind as well as to entertain it."

JOHN R. SAUNDERS

MALE AND FEMALE

----------by Margaret Mead

William Morrow, $5.00

477 pp.

IN this book of 477 pages, the celebrated woman anthropologist undertakes to explain the physical basis of the sexes, division of labor between the sexes, the influence of parental attitudes on psychological development, and sex customs in the United States, as well as woman's proper role in human society. Much of the evidence comes from her own extensive studies of several South Sea societies. But not all. Everything is grist to Dr. Mead's mill—the advertising methods of American business, the child-rearing practices of ancient Japan, the kinds of movies produced in Hollywood, and the songs that were popular in grandfather's day.

The thesis, as I understand it, is that our society has failed to make full use of special gifts of the feminine sex and thus denied itself many benefits. By virtue of the biological differences between the sexes and between their childhood experiences, as well as differences in their reproductive experiences, women see the world in different ways than men. Dr. Mead reasons that by recognizing and cultivating the special superiorities of both sexes, a better world can be built.

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Dr. Mead embraces the currently fashionable theory of "character types" for different societies. She explains the variation in concepts of masculinity or femininity primarily in terms of the attitudes of adults toward children. Her interpretation is frankly psychoanalytical. For example, among the Arapesh a baby is treated as "a soft, vulnerable, precious little object, to be protected, fed and cherished." It is offered the breast frequently even though it may not be hungry. Never does the infant have to seize, bite, or hold the mother's nipple. Infants are carried in bark slings and have no need to grasp or hold on.

The Arapesh child grows up, therefore, with a passive, receptive attitude toward life. The female has little trouble in carrying this general attitude over into adult sexual relations. "To transfer an attitude of pleasant expectancy from mouth to vulva, of soft, optimistic retentiveness, requires very little shift in attitude." But males reared in this fashion are so lacking in habits of dominance and aggression that they fit into the role of a husband only with the greatest difficulty. They are unwarlike, easily conquered, and enslaved. Even in hunting, they reveal the effects of early childhood experience, for instead of stalking and killing game, they set traps and wait until an animal falls in.

Two points are stressed again and again in *Male and Female.* First, that the adult personality is to a large degree shaped and patterned by the child-rearing practices of the culture; and second, that the transformation from male infant to adult man usually involves a much more difficult psychological adjustment than the change from female infant to woman, regardless of the particular society involved.

Our own society, according to Dr. Mead, is suffering from emotional inflation. Our levels of aspiration so greatly exceed any possibility of actual attainment that we live in a state of chronic anxiety. This generalization applies to all phases of our lives, but Dr. Mead is here

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primarily concerned with the ways in which it affects relations between the sexes. In a chapter entitled "Can Marriage Be for Life," she points out the discrepancy between idealized "till death do us part" sentiments and the statistics on divorce and separation. It is unrealistic and unethical, according to Dr. Mead, for the State to permit any two people to marry merely because they have mutually consented to do so, and then to raise legal barriers against the dissolution of unsuccessful marital partnerships.

This book is too full of ideas to lend itself to condensation or even adequate representation in a short review. It is, first of all, a thoughtful, penetrating analysis, and the facts it contains should not be recounted except within the author's frame of reference. Nor can a reviewer label the work as "good" or "poor" and let it go at that. Too much depends upon one's willingness to accept the author's use of the facts. In the beginning of the book Dr. Mead explicitly states that she is presenting only her own point of view and that others might employ the same facts to support a different theory. This declaration does not, however, relieve her of the responsibility of discriminating for the reader between fact and intuition, between data and interpretation. And sometimes she seems to represent as factual, things that are, to say the least, open to question.

Personal reactions of a reviewer usually reflect differences or similarities between his tastes and those of the author. For example, many of the psychoanalytical interpretations in *Male and Female* strike the present writer as extreme. But in all fairness it should be added that this may represent the generalization of a negative attitude toward much that is included in the orthodox analytic point of view. A second negative reaction rests upon the feeling that Dr. Mead's literary style is unnecessarily involved and repetitious. Having stated a general point, she sometimes proceeds to particularize with one example after another until the reader becomes impatient or bored.

In the chapter entitled "Human Fatherhood Is a Social Invention"—a title, incidentally, that is apt to startle biologically-minded readers—Dr. Mead ingeniously weaves together a great deal of material to show that the human male's tendency to nurture his wife and children depends upon learning or social inheritance and is not "instinctive." The female's impulse to feed and protect her offspring is, in contrast, rooted in her biological inheritance. Several objections can be raised against this point of view. In contradiction to Dr. Mead's statement, care of the female and the young by the male is not limited to *Homo sapiens*. It appears, for instance, in lower mammals, such as certain species of mice, and in some carnivora, including wolves. Furthermore, male chimpanzees living in their natural state do protect immature members of the group. Dr. Henry Nissen has recorded instances in which the ruling male of an ape group picked up and carried to safety young animals that were threatened with danger.

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In the main these are carping criticisms. As has been stated above, the meat of this book is in the ideas it contains instead of the facts it presents. The ideas are, as are all of Dr. Mead's, stimulating and instructive. Whether one quarrels with her interpretation or finds it completely adequate, no one can read her writings and fail to profit thereby.

Frank A. Beach

THREE WORLDS OF PERU

------------ by Frances Toor

Crown Publishers, $3.50
239 pp., 75 photos

ALTHOUGH this book is organized and written as a travel journal rather than as a conventional guide, it is likely that it will be employed from the latter point of view, and I am, therefore, criticizing it with that usage in mind. Unlike her predecessors in the field, Miss Toor covered Peru systematically in her travels, and her observations are presented in accordance with the three principal geographical regions of the country, the coast, the *sierra,* and the *montaña.* That the highlands are emphasized is only natural, since without question the high Andes hold the greatest store for the foreign visitor.

It is clear that the author, although impressed by Peru's great archaeological monuments, is far more interested in the present-day population than in the past. History and archaeology, therefore, receive no systematic treatment, which is, perhaps, as well, since Peru's colorful

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history and imposing ruins have been described time and again. The Indians, Mestizos, and Whites, on the other hand, receive considerable attention, and some aspects of the contemporary scene—especially fiestas—are described in some detail. For the benefit of the tourist a calendar of major fiestas has been included. Of particular interest, however, even to the specialist, are Miss Toor's first-hand descriptions of ceremonies and celebrations in out-of-the-way villages of the coast and highlands. But although the author appears to be a sensitive and accurate observer, her choice of informants is often uncritical, and she not infrequently goes astray in the matter of interpretation.

In spite of a number of irritating errors, however, each region of Peru is characterized with surprising accuracy and with attention to its special flavor and feeling tone. It is a pleasure to read a travel book by one who so honestly liked, sympathized with, and appreciated the country and the people.

HARRY TSCHOPIK, JR.

TROPICAL AQUARIUMS

------------ by Ian Harman

Illustrations by Humphrey Dakeyne

Sidgwick & Jackson Ltd., London, 10/6
168 pp., 54 drawings

THE tropical fish fancy has engendered its share of books purporting to explain the intricacies of tank management to the novice and the refinements of aquarium practice to the more experienced amateur. None of these has been completely successful, however, largely, we believe, because they have devoted too much space and effort to uncorrelated facts and not enough to the principles underlying the proper maintenance of small fishes in captivity. Not that the fancier needs, or wants, a book on the physiology or ecology of his pets! He does need, however, a general, more or less basic knowledge of the part played by the water, sand, plants, appurtenances, fishes, and other life in his aquarium. No author can hope to cover even a fraction of the exigencies that can arise—situations that can only be met by applying properly understood principles.

This book suffers from the same defects as its predecessors; not enough is said in its introductory chapters on how to set up and operate a tank. What *is* said is in general accurate enough. We might quarrel with the advice given to feed one's fishes several times a day, although this is good practice if minuscule enough amounts are given each time to avoid overfeeding. In common with the great majority of aquarists the author misunderstands the functions of plants in aquaria, believing that they serve to oxygenate the water.

The American aquarist will be interested in the contrivances upon which the austerity-ridden British fancier must depend for heat, light, and aeration, and will consider himself fortunate in having both the mechanical devices and the power to run them readily at his disposal.

JAMES W. ATZ

THE AWL-BIRDS

----------- by J. K. Stanford

The Devin-Adair Company, $2.00
90 pp., 28 illusts.

IN the populous home island of the British not a few species of birds have disappeared as a result of mistaken activities by gamekeepers, the draining of marshlands, and other pressures of human occupation. One of the birds that recently came back from the Continent to nest in England after more than a century is the graceful avocet, a shorebird with a thin upcurved bill like a cobbler's awl.

There was grave danger that "British-taken" avocet eggs would tempt covetous oölogists; hence special efforts were made to guard their nests. This much is fact. Mr. Stanford has dramatized the story and woven in many incidents typical of postwar Britain. The precious eggs, on the point of hatching, are saved from a predatory collector, and retribution comes upon the villain in appropriate but unexpected fashion. The tale is well conceived to arouse fervor for the protection of rare birds. Mr. Hughes's pen-and-ink sketches are an admirable complement.

JAMES P. CHAPIN

THE INDIANS OF THE SOUTHWEST

A Century of Development Under the United States

------ by Edward Everett Dale

University of Oklahoma Press, $4.00
283 pp., 16 plates, 5 maps

THIS book deals with an important and neglected aspect of United States history—the relations of the Federal Government with the Indians inhabiting that vast territory acquired by treaty from Mexico in 1848. It is a bitter history and, until very recently, one of broken pledges, shameful neglect, maladministration, and bloody warfare. The area covered extends from central New Mexico to central and southern California, once a wilderness of deserts and mountains peopled by Indian tribes of widely differing cultures.

Friends of the Indian, the author contends, are often prone to condemn the Indian Bureau, particularly during its formative years, for bungling and mismanagement. He shows, however, that in many instances—as during the gold boom in California—ineffective handling of Indian affairs must be blamed on the inherent difficulties of the task rather than upon any lack of good intentions.

In his eagerness to be fair, Mr. Dale speaks repeatedly of "definite objectives" and "established policy" of the government when discussing Indian administration from Grant's presidency to the early twentieth century. Yet any clear-cut aims and goals during this period are difficult to perceive. The plight of the landless Mission Indians was virtually ignored until cries from the California press made action inevitable, while Navaho and Pueblo administration was characterized by quarrels between military and civil officials and by graft and corruption on the part of political appointees.

Although the history is detailed and meticulous, it is history in the narrow sense, unrelieved by any deep understanding of the Indian cultures involved. Current problems are discussed almost exclusively from the administrative point of view, while pertinent recent literature on the Indians' attitudes and adjustments has been completely ignored. The author has, however, done an excellent job of assembling and editing important and inaccessible data from government archives, newspapers, and unpublished manuscripts.

HARRY TSCHOPIK, JR.

16MM SOUND MOTION PICTURES

----- by W. H. Offenhauser, Jr.

Interscience Publishers, $10.00
580 pp., 123 figs.

THOSE who are graduating beyond the usual 16mm motion picture camera to full sound moving picture equipment will be interested in this new book. It answers almost every conceivable question on the use of the various types of equipment and on the technical processes involved in the production of the finished film.—ED.

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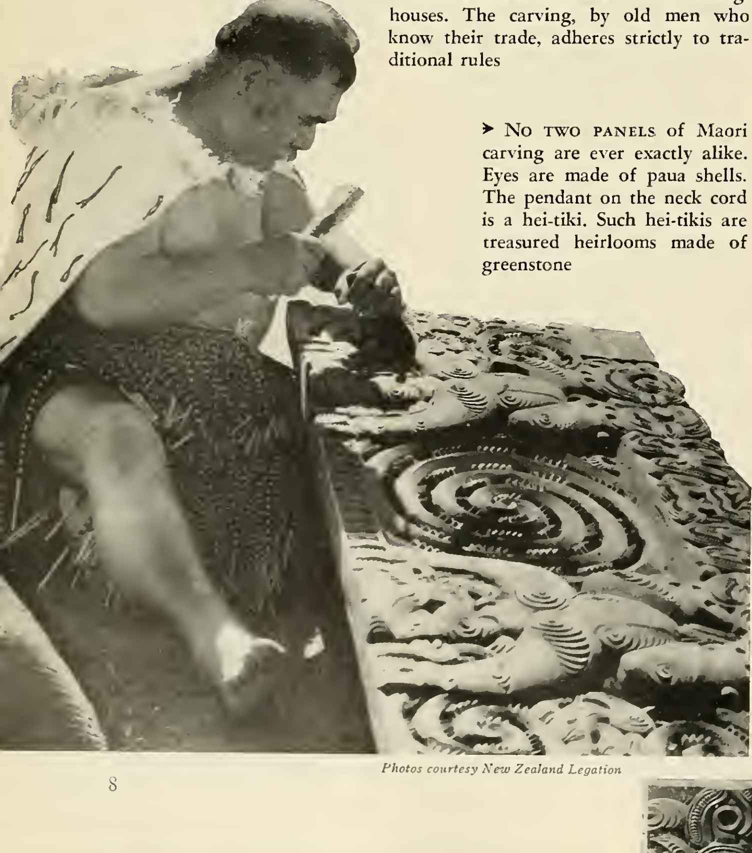
The Maori

THE enormous stretches of the Pacific Ocean are becoming more and more of a laboratory for scientific research, due in large measure to the Pacific Science Congresses, which have been meeting in its various parts. Roughly spaced at three-year intervals, except for a longer war interruption, seven have now been held, in Hawaii, Australia, Japan, Java, British Columbia, California, and in 1949, New Zealand. The Eighth Pacific Science Congress will meet in the Philippines. The work that has been accomplished is tremendous and has led to far-reaching programs for current and future study.

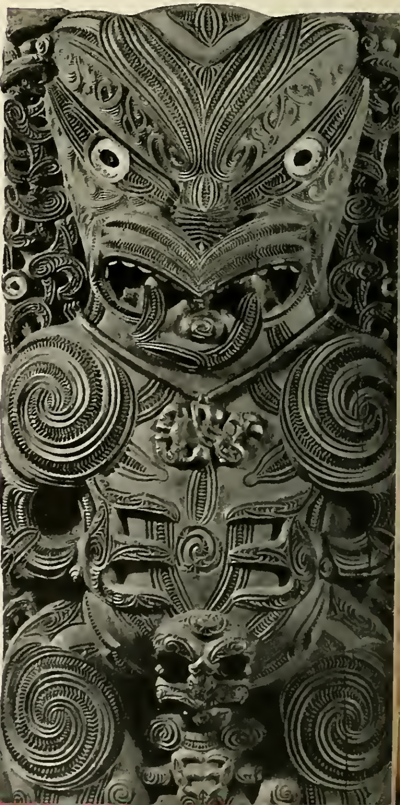
All branches of science are included: zoology, oceanography, every kind of medical work, fisheries, agriculture and conservation, education, and more. The subject of anthropology could not fail to win

▲ PRINCESS TE PUEA and your author on the steps of the meetinghouse at Ngaruawahia Pa

▼ THERE ARE MANY new Maori meetinghouses. The carving, by old men who know their trade, adheres strictly to traditional rules



➤ NO TWO PANELS of Maori carving are ever exactly alike. Eyes are made of paua shells. The pendant on the neck cord is a hei-tiki. Such hei-tikis are treasured heirlooms made of greenstone



Photos courtesy New Zealand Legation

Were Our Hosts

An unusual visit with the natives of New Zealand —an ancient and noble people whose cultural rebirth has won them world-wide respect

By Grace E. Barstow Murphy

Photographs by Athelstan Spilhous unless otherwise credited

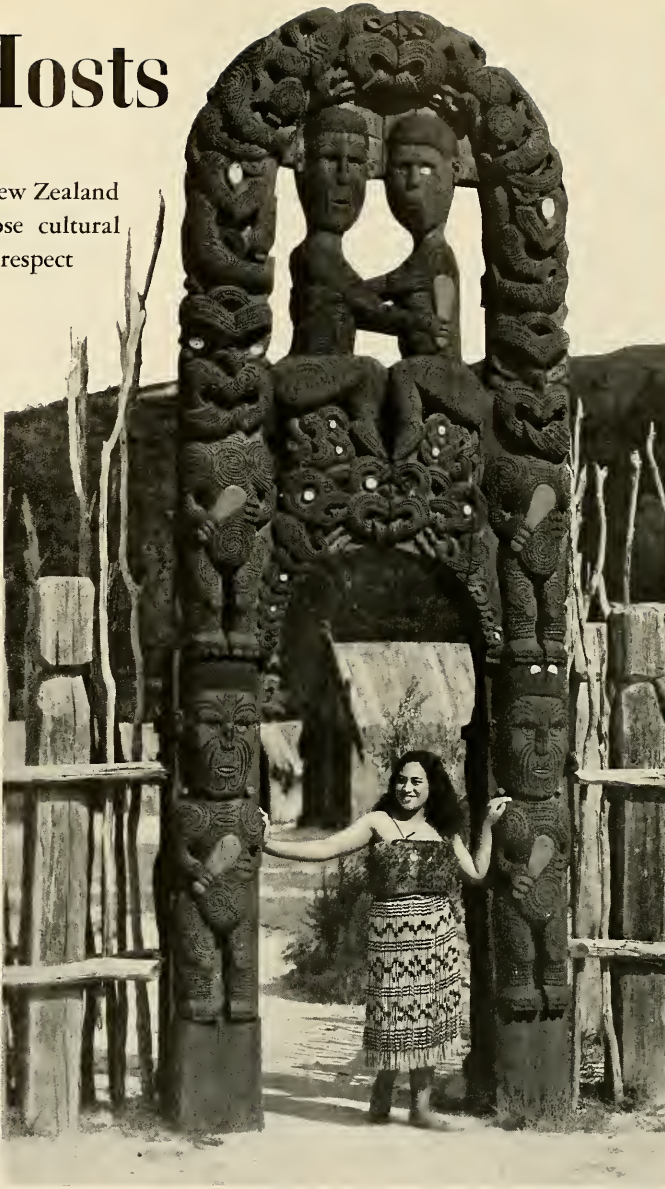


Photo courtesy New Zealand Legation

▲ One of our Rotorua friends. Each of the ancestral weapons on the gate carvings is called a "mere"

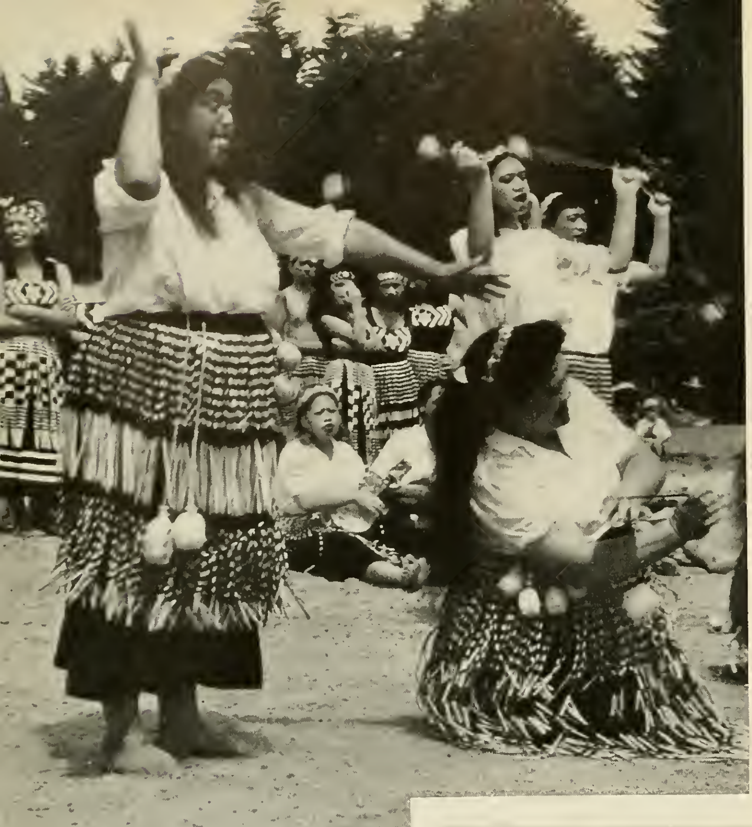
particular interest, because the Pacific peoples from Hawaii to New Guinea fascinate everyone who thinks about them.

Modern anthropology has a new approach. The world's foremost anthropologists no longer treat the native like a butterfly on a pin or a squirrel in a cage. Rather, he is treated as a friend, and it is considered a privilege to approach him and to learn his way of life. That spirit prevailed at the sessions of the Congress that I attended in my capacity as delegate. I have never known livelier scientific discussion than that among the anthropological scholars of a score or more of nationalities gathered first in Auckland for a week and later in Christchurch for a second session.

In between these sessions, the various groups of scientific folk were sent traveling by the Government of New Zealand. Big, comfortable buses were supplied each group, each with a leader to keep us informed, follow the itinerary, and arrange for our comfort. It was science, but it was holiday. Holiday for scientific people generally means more science in a different garb.

The focal point of our eight-day anthropological tour lay in the person of Sir Peter Buck, who had come home after many years away. He is half Maori. He grew up among the Maoris like any other Maori boy. However, he went much further, after his graduation from college, than do most boys of any race. He became a full professor at Yale, without doubt the only one whose grandfather belonged to a cannibal tribe. He has held for many years the directorship of the great Bishop Museum in Honolulu. He is the most noted ethnologist in the study of Pacific peoples.

But in New Zealand, he is the loved member of his race. At mention of his name, Te Rangi Hiroa, to any Maori, smiles of pride and deep affection break forth. I have seen it happen many, many times. In his visit of 1949, he was the son, the brother, the father, of every Maori in New Zealand. Which, of course, meant fatted calves and cel-



▲ A JESTING DANCE with the long poi. Judging from the facial expressions, the singing in Maori is probably full of fun. Note the difference between the long poi and the short poi fastened at the belts of the flax skirts

ebrations. He must have visited nearly all the villages. As hospitality is part of education in Maori culture, the entertainment was superb. We pakehas, as the Maoris call our race, Sir Peter's friends and colleagues, were included. In village after village, dancing, feasting, speech-making, welcomed him, and us.

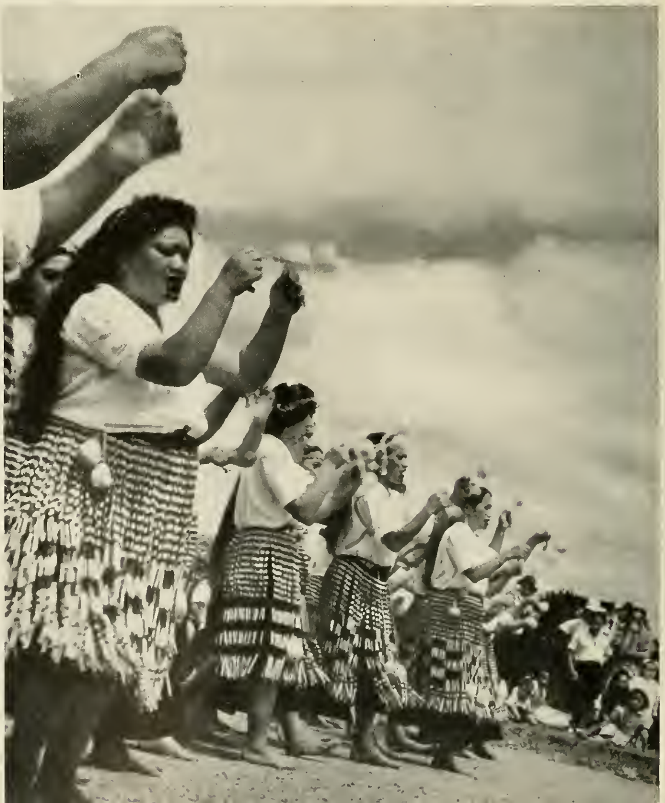
In each pa, the procedure and settings differed sufficiently to keep one's interest very alert, but the pattern was the same.

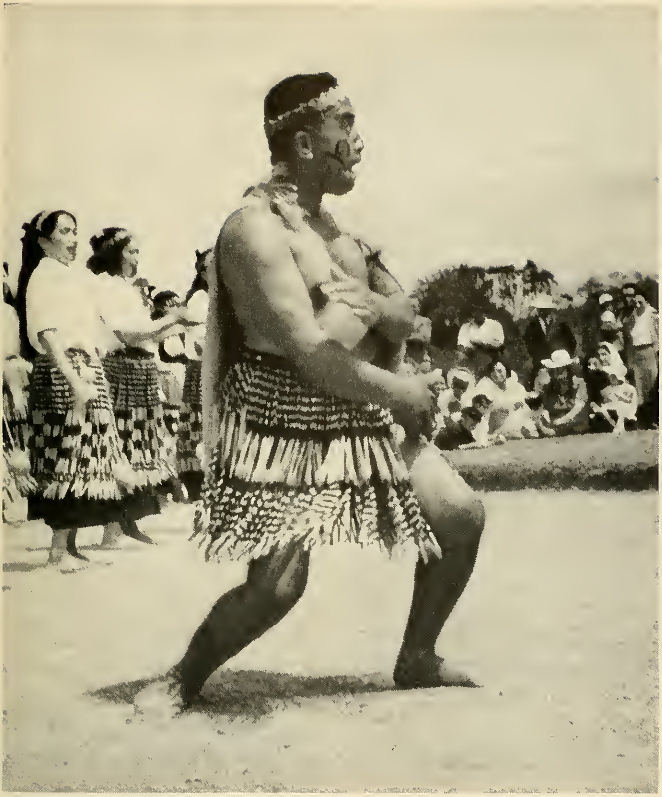
I use the word "pa" advisedly. In the old days, pa meant a fortified village, with an intricate system of ditches and barricades, often arranged on a hilltop. *Kainga* was the word for an unfortified village. Today, long after the time of need for such fortifications, many scholars use the word "pa" for the usual Maori village, of which there are hundreds in New Zealand.

Our party reached the first village, Ngaruawahia, at about eleven of a warm, sunny, midsummer, February morning. There were over twenty of us, three women and the others men. We were all excited at the unusual chance to enter into tribal customs practiced over centuries, to see such dances and share in such feasts.

We gathered outside the carved arched gateway, flanked with beds of brilliant flowers. The red ochre on the carving keeps troublesome forest spirits outside where they be-

▼ POI BALLS FLY in perfect synchronization. Only the old women in the villages have real tattooing on the chin and lips, but this woman has painted an old design on hers. Stout women are as light on their feet as girls





▲ FACIAL CONTORTIONS are an important part of Maori posture dancing. Tongues shoot out incredibly, and the whites of the eyes are made to look enormous. The old war dances were extremely terrifying

long. Every custom of the Maoris has some such explanation.

Against the mountains that are always the backdrop of New Zealand scenes, we could see inside on the village green a gleaming group of brown, half-naked warriors.

A chief detached himself and dashed toward us, brandishing a long and slender weapon, leaping, yelling, making faces, tongue out in defiance, eyes rolling. It was fearful. I almost ran. He was naked except for the swishing flax skirt that he wore over shorts.

He stopped in time. His anger turned to courteous pleasure. He began to lead us in. Again he whirled upon us, driving us back with his ancestral weapon, grimacing furiously. Again he turned and led us in. He joined the group of warriors. They did a leaping dance of welcome.

The feathered, spearlike club carried in this dance is a taiaha, used both ceremoniously and in actual fighting. Its technique was taught as carefully as that of sword or foil. Training in arms was ceaseless with the Maoris. A beginner learned to watch fixedly the big toe or the shoulder point of the adversary. The toe clenched downward, the shoulder showed a muscle movement a split second before a blow was to be delivered. The dance-trained warrior, never standing still, agile and light on feet, could leap aside. It is reported that when firearms came in, a Maori could sometimes dodge a bullet by a quick movement at the flash of the gun.

When the men finished their lively welcome, the mood changed, and the old women of the tribe, waving wreaths of leaves and branches, danced a tangi for the dead. We stood silently and quietly, our heads bowed. It must be pleasant to know that one will always be remembered, in affection, in one's Maori home.

After that short seriousness, everything was gay. We were led to benches on one side of the marae, or open space before the meetinghouse, sitting in the sun at right angles to the porch that sheltered Sir Peter and his Lady. Our hosts sat opposite. Sir Peter sent for me, and I sat near him, more comfortable in shade. As soon as one dance stopped, another started. Nearly all were posture dances, called the haka. Their ability to express their ideas in motion is so great that one could almost

▼ THE RED OCHRE PAINT of the carved gates of the villages keeps out evil spirits. We would stand waiting till ushered in by dancers. The significance of the three-fingered hand is lost in the past. The protruding tongue symbolizes defiance

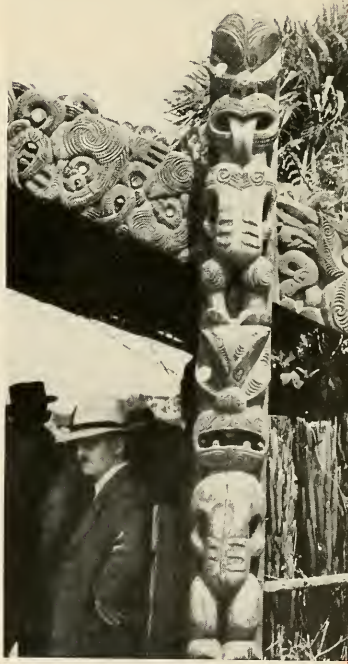


Photo courtesy New Zealand Legation

▲ **Sir Peter Buck** with the Governor-General, Sir Bernard Freyberg, V.C., at Government House, Wellington, on the occasion when Sir Peter was invested with the insignia K.C.M.G.

follow the meaning of the singing even though it was in soft-toned Maori. The men knelt on one knee, weapons on the ground, while the women came toward us in the perfect synchronization of their dancing. Rhythm flowed throughout their bodies, hands and feet, and all their muscles. Fingers added movement in a lovely grace.

The poi dances are done with two flax balls on a six- or eight-inch string, one in either hand. The dance called the long poi uses balls with strings perhaps two feet long. Whichever length is in use, the balls move in absolute precision and at lightning speed, over the shoulders, under the arms, crossed, uncrossed, in a maze of figures followed in accuracy by long lines of dancers. They are taught, of course, from childhood. A mistake made in the dance is traditionally bad luck. Their carefree, happy natures find outlet in this dancing. The older women join the young, full of fun and nonsense, light as air in spite of heavy pounds. Everybody dances, but the rules and patterns are followed in accepted discipline.

Each flax skirt takes months to make. The men's end above the knees, but the women's fall generally to the ankles, over full skirts. Nearly all wear headbands, often with feathers in them, their long black hair flying loose. The women's bodices are often bright with embroidered bands. At the Rotorua celebration a few days later, the costumes, though still Maori, were influenced by our modern stage. Skirts were short, and more emphasis was laid on color.

The designs of the skirts are dyed onto the flax. The parts to be colored are scraped, the rest left natural. The strands are soaked in a bark infusion and then buried in black mud, which stains the scraped parts. The sound of the fibers is delightful as the dancers move.

One leader of the women wore a feather robe—undoubtedly a treasured heirloom. The Maoris have never done weaving as we know it. They made material for clothes by finger-weaving strands of flax. In the feather cloaks, each feather was tied in place by hand. When one hears careless modern whites call the Maoris lazy, one wants to recommend a course of reading. Until the early settlers came, they had no time for laziness. They had to work hard.

When they arrived from hotter climates 600 years ago, their whole culture had to be readjusted to lower temperatures. They found New Zealand flax, tried out the different kinds, chose one, grew it with care, and learned to make their clothes. They had as hard a job with food. The tropical plants brought with them in their great canoes, such as breadfruit, would not grow in New Zealand. Only the *kumara*, or sweet potato, survived easily. Some taro grows in the North Island. They learned which native ferns were good to eat. They worked out a laborious system of agriculture. They had 27 names for 27 different kinds of soil. They learned the ways of unfamiliar birds and fishes and how to catch and preserve them. They became experts in everything they attempted. And life was dedicated to their art to such extent one wonders how their years were long enough to complete their work. Every war canoe was carved from end to end, taking years to build. The task of felling enormous trees with basalt and greenstone tools seems an impossible one.

That the Maoris lived in the Stone Age, like most Pacific peoples, knowing no metal until the beginning of the last century, seems to me to make their story one of the most surprising records in history. Metal has been taken for granted for so long throughout nearly all the world. To them, "greenstone" meant what "golden" does to us—a word carrying the thought of something precious: "a golden opportunity," the "greenstone door" to everlasting peace. Greenstone is a jade almost as hard as steel. Its discovery in New Zealand was a rich one for the Maoris. Yet how they worked it into smooth, sharp, symmetrical tools, weapons, and ornaments, sometimes with carving on them, is one of the wonders of human attainment. Dr. Skinner, Director of the Otago Museum in Dunedin, spent hours of his busy days showing me the vast collections of the Maori greenstone. Many dancers wear greenstone tikis as jeweled ornaments, hanging from cords around the neck. They are shaped somewhat like human embryos. The significance of some of these things is lost in hazy history, as the Maoris had no writing of any sort for keeping records.

Such thoughts played through my mind as I watched the rhythm and infinite grace of the dancing, while a tiny child wandered about the marae, climbed up onto the porch, then onto Sir Peter's knee.

The dancing stopped. Speeches began. Through all the centuries, speeches made on the marae have been a most important part of Maori life. All the Maoris are orators. Their flowing, flowery language serves such purpose well. It is a Polynesian dialect, similar to Hawaiian and Tahitian. The speakers were wearing ordinary clothes. Each speech was translated, then answered by one of our own party. Sir Peter grew rapt in Maori, more casual in English. He told his people that though he had been away, he had worked throughout the years on Maori matters. He thanked them for their welcome. At one pa, he fell exuberantly into some haka steps. The speakers extolled his Lady for the support she had given him. They extolled the scientific folk in words that sometimes ran: "We always welcome the Government people. They are our contact with the outside world. It is to them we must offer our thanks for this opportunity of greeting the scientists . . . You, as our guests, represent to us our forebears who have departed. You were with our sons at the first World War and are instrumental in bringing with them peace to the world . . . Pakeha education has been felt in this district. May the scientists leave something of use to the Maori . . . Bring with you the baskets of knowledge from Io . . . You from the many islands of the Pacific and continents of the world, we are asking ourselves the reason for your visit to our district . . . Welcome to New Zealand! Welcome, and bring the knowledge from those places from which you come and share it with us. Our people have helped the world. You see their record. Welcome, good health and prosperity."

Our Dr. Ryerson, Chairman of our American delegation to the Congress, was charming in his handling of our thanks and tributes. The Fijian, Dutch, Indonesian, French, Australian, New Zealand scientists of our party, and the other Americans also caught the spirit of the friendly Maoris.

The many speeches finally over, our hosts lined up, and we passed by them, shaking hands. We entered the meetinghouse through the carved door.

I later went into many beautifully carved meetinghouses where there was no furniture at all beyond a few mats or mattresses on the floor. Originally, Maoris never had furniture. But in this one, envisioned by

▲ THE SWISH of the flax skirt makes a lovely sound to accompany the soft singing. This man's face is painted to look like "moko," or tattooing

Photo courtesy New Zealand Legation

➤ THE PAINFUL APPLICATION OF "MOKO," a custom taught to Maoris by their gods in dim history and followed till recent times the Princess, Te Puea, who was about to join us, deep chairs and sofas, flower-covered tables and rugs, invited us to comfort for as long as we could stay. Taste and style were flawless. The arrangements were more homelike than is usually found in a room 80 feet long. The walls and rafters followed the intricate order of Maori architecture and design, with the one difference that there were many windows. Panels of woven flax in color separated the great carved panels, each of which differed from the other, yet all were similar in plan. Brilliant design in red, black, and white decorated the rafters. The long ridgepole was carved. Feather cloaks hung on the walls with ancestral weapons, and grass skirts served as curtains. The far end was blocked off as a small and very choice display of treasures.

As the Princess joined us among these colorful, luxurious appointments, we rose as a body to greet her.

She wore a bright-flowered calico blouse, which hung outside her long, black cotton skirt. She walked erect on the bare feet that have carried her forward, inspired by her vision, to a leadership of the Maori race. A black scarf half covered her soft white hair, accenting her wide mouth, large well-set brown eyes under strong brows, and her shapely nose and chin.

She had just been eulogized in speeches on the marae as the outstanding Maori of her age and generation. Her people had been disintegrated and disheartened. In her vision she was told to mold them together again, never giving up her goal.

She walked slowly, for she is not well. There was no pomp and circumstance of royal birth and no sign to separate her from the scores of brown-skinned Maoris with us in the whare runanga. No sign, did I say? There was a strength and knowledge of living in her face which should go with every such title as the Princess bears. To her sympathetic understanding, credit is given for the slow and difficult adjustment of the Maori to the pakeha world. She is called a striking example of what influential Maori leadership can be and what it can accomplish. A lesser race than hers would long ago have knuckled under to the impact of foreign aggression. There is intellect in the Maoris. Their system of communal living, coupled with an aristocracy, all without any economic striving, stressed and developed mental qualities.

Their ancient schools, called whare wananga, attended by the first men of the tribes, trained them in philosophy, religion, ritual, tapu. Their mythopoetic lore holds as great a sensitiveness to life and beauty as can be found in that of any race. Though they had no form of writing, their memories were trained to prodigious capacity. White men alive today have heard old Maoris chant 1400 names and stations of their ancestors. No mistake was permitted.

With such a history of minds revered and trained, it was not strange that the Young Maori Party arose out of the general disintegration of the race, a few decades ago. Men like Sir Ngata Apirana, Sir Peter Buck, and others joined together to block the downward path toward complete destruction. Population decrease stopped. Increase began. Hope awakened. These modern Maori intellectuals are educated in Te Aute College. It is hardly possible for untrained Europeans or Americans to comprehend the racial habits and the needs of so different a culture. In the educated Maoris there is combined an understanding of the best in both the races, whose difficult relations in New Zealand have always been colored by a mutual respect. It is significant that in 1948 the name of the government's Department of Native Affairs was changed to the Department of Maori Affairs. None of this means that problems are solved. There is still disease and poverty, bad housing, and bad feeling over land. It means, however, that the best men of both races are working toward well-chosen goals. It means that the time was ripe for good work to be accomplished by the Princess. She taught her people that they could not live in the memory of wrongs. She modified their attitude toward the Government in such matters as the Waikato land development schemes, teaching co-operation and its value. "Work with the Government, not against it," was the wisdom that she taught. She has raised money for homes for orphans and landless people in her own village, Ngaruawahia. The beauty of her village is due to her planning.

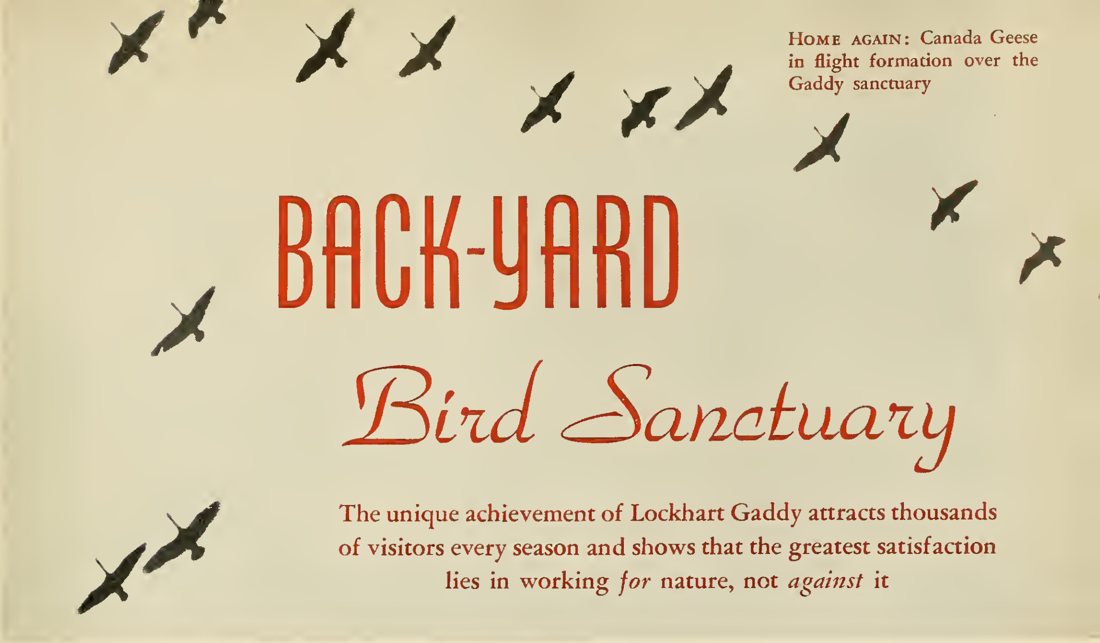
In 1925, Elsdon Best in his book, *The Maori*, wrote of the decadence of Maori art. In 1940, Professor I. L. G. Sutherland, who edited the compilation of papers called *The Maori People Today*, recorded the revival of Maori arts and crafts. These two books alone, both out of print but available in libraries, give a well-rounded understanding for those curious to know something of the situation.

The room that held us proved Te Puea's conviction that it is possible to unite modern comfort with Maori tradition and background. Housing is notoriously bad among the Maoris. She had four-room houses built, combining Maori materials, style, and construction with pakeha sanitation, at a quarter of the cost of a pakeha house. She knows what is essential to the Maori's culture and what are the demands of his different background. She knows his pride of race and his requirement of a communal existence, combined with an aristocracy of tribal chiefs. She knows his need of art, of humor, and of dancing, his mythopoetic lore and his pride of ancestry. She also knows his need of the benefits of white civilization. The upper class of Maoris from earliest times saw little difference between the cult of their Supreme Being, Io of the Hidden Face, and the doctrines of the missionaries. By means of such clear-eyed vision today as theirs was then, the race is being led to new confidence and attainment.

Generally, the meetinghouses consist of only one room. Te Puea's has several rooms, including a modern suite with bath, for guests.

We passed through to a dining room where lace-covered tables groaned under five times as much

Continued on page 48



HOME AGAIN: Canada Geese in flight formation over the Gaddy sanctuary

BACK-YARD Bird Sanctuary

The unique achievement of Lockhart Gaddy attracts thousands of visitors every season and shows that the greatest satisfaction lies in working *for* nature, not *against* it

By EDWIN D. NEFF

Photographs by HUGO H. SCHRODER

LOCKHART GADDY used to be a hunter.

Now he refuses to hunt.

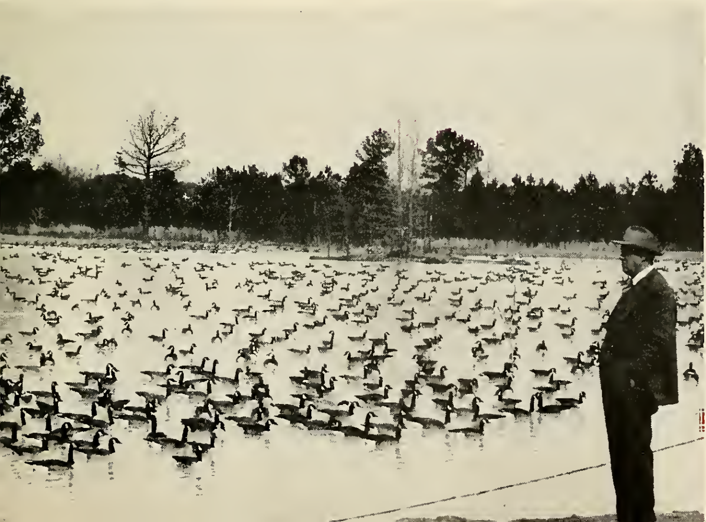
He used to lie behind the cold, damp blinds of the Carolina marshes, gun in hand, waiting for the cry of the great gray geese sailing high across the moon. Later, if he was lucky, the Gaddys would dine on succulent roast goose flooded with rich goose gravy.

Now Lockhart Gaddy and his wife cannot abide roast goose. Yet less than an hour's walk from their farm near Ansonville, North Carolina, thousands of fat Canada geese paddle smugly about a great pond from October till March. Further, the Gaddys are feeding the geese these days!

Mr. Gaddy, you might say, has got a kind of religion. He no longer belongs to those bands of "sportsmen" who prefer to study Nature through a gunsight. Instead of hunting geese, he protects them. He has built the most unusual wild goose refuge to be found anywhere in the United States. It is known to bird lovers and the public throughout this country and in many foreign lands. Needless to say, the Lockhart Gaddy refuge has a wide reputation among geese.

That Mr. Gaddy's change of view came about accidentally is none the less to his credit. The fact remains that he is now a sensationally successful conservationist and is inspiring others to follow in his steps. Already, a neighbor has built a small goose refuge.

The state of North Carolina has given legal recognition to the Gaddy sanctuary, and hunters are forbidden within a half mile of the little spring-fed lake which Gaddy himself built and has twice enlarged.



◄ SINCE LOCKHART GADDY put away his shotgun in 1934, his little lake has become increasingly popular to wintering birds, and the world has stamped a beaten path to his door. Naturalists and camera fans have an unusual opportunity to study the birds at close range

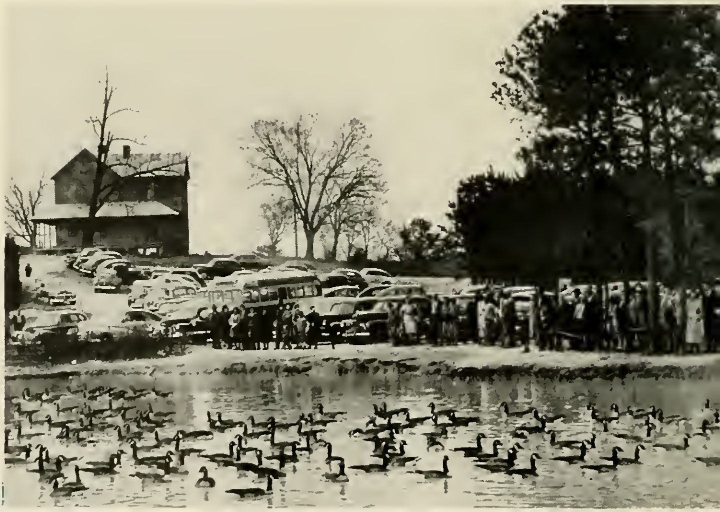
➤ CLOSE-UP of two Canada Geese, one well out of the water

Gaddy's place is gathering a kind of fame as well as spreading the gospel of conservation. Thousands of visitors pour in over week ends and gladly pay for the rare wonder of seeing wild geese no farther away than you can throw an ear of corn. Mr. Gaddy makes little money on his admission charge of 25¢, because the geese eat 1200 to 1500 bushels of corn in a season.

This, then, is the story of what a single individual has done, even in these times of hustle and bustle, to bring the pageant of Nature to his doorstep.

The story begins nearly fifteen years ago, when Mrs. Gaddy's mother, Mrs. Pattie K. Ross, who loved to fish, suffered failing eyesight. It was no longer safe for her to fish the tricky current of near-by rivers, so Mr. Gaddy built a one-acre pond on his farm. Also using the pond were a number of tame geese, which Gaddy had used as live decoys in the days when the law permitted. Though these creatures had long since become corrupted by the easy life around the farm, they still echoed their age-old cry when wild geese were flying overhead.

One autumn day, Mr. Gaddy was surprised to discover that his decoys had called down nine wild Canada geese to the tiny fish pond. The wild ones decided to stay instead of moving south with the flocks, and actually remained all



➤ AS MANY AS 3000 visitors come to the Gaddy refuge on a Sunday. This singular spot is an urgent attraction to every nature-minded traveler on his way through North Carolina winter. At first, of course, they zoomed off every time Gaddy got near the pond. They wouldn't touch the shelled corn he left for them. Finally, they came to accept corn on the cob, but only if the ears were mashed into the ground. Two months passed before the wild geese would allow Gaddy to approach the pond while they were around, and even then they remained on the opposite shore. That was in the fall of 1934.

The following year, the Gaddys found themselves glancing hopefully toward the sky every time a flock of geese passed by. Imagine their delight when 35 Canada geese suddenly detached themselves from formation and swooped down to the pond. The new winter visitors, however, were just as wary as the first nine. Whenever anyone approached the pond, they flew off or scuttled to the other side.

The third year the goose population of Gaddy's little pond rose to more than 100, and by the following year, nearly 500. The early comers must have inspired confidence, because the new birds were much more tolerant. They accepted food graciously and allowed themselves to be approached within a reasonable distance. From then on, the flocks increased every year, arriving by the first full moon in October and remaining until the first full moon in March. During the 1946-47 season, nearly 6000 of the great gray honkers were demanding reservations. The following summer, the number had leveled off a bit, but Mr. Gaddy expects the average to become about 6000 per season. During these years the number of human visitors to Gaddy's astonishing sanctuary also had increased, until now anywhere from 1500 on a bad-weather Sunday to twice that number in good weather can be counted on. Several hundred appear on weekdays. All this is small wonder, for the Gaddy pond is a photographer's paradise.

All varieties of flight shots are possible from close range. When a sudden movement startles the birds off the pond, a speed shot will record wings in every flying position. Groups of birds leaving shore can be snapped with tails toward the camera, displaying the prominent white markings seldom seen by the casual observer. Flocks coming in from foraging expeditions often stunt, performing sideslips, rolls, and all manner of aerial acrobatics.

As the little pond began to attract larger numbers of geese, Mr. Gaddy began to be troubled by shotgun artists, as well as cameramen. The huge concentration of geese drew hunters from all parts of the state, threatening the birds with mass slaughter whenever they left the pond. Finally, the State Legislature was persuaded to close the area to hunters within a half mile of the pond. This gave the birds a chance to gain a fairly safe altitude on the take-off before passing over dangerous country.

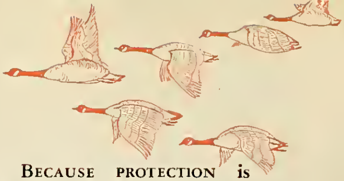
On moonlight nights, the wild geese leave the pond for distant feeding grounds, returning just before daybreak. When clouds obscure the moon, they wait until dawn for their flights.

They are still wary. Wild Canada geese are intelligent and will note the slightest change in their environment. If a visitor approaches from the pine woods instead of from the path leading to the Gaddy farmhouse, they become alarmed. Then the usual goose *yakity-yak* changes to a fearful cackle. If the visitor behaves himself and avoids sudden motions, however, the talk returns to conversational tone.

Once, a photographer who had been using a small camera switched to a large type which required a tripod. Instantly, the geese became suspicious and moved offshore. But within about a half hour they had decided the new gadget was harmless and began to move about freely once more. They have become quite friendly with the Gaddys, however, and will approach to within eight to ten feet. A visitor who is accompanied to the pond by Gaddy gets a much better reception than if he comes alone.

While Canada geese are by far the most numerous wildfowl on the Gaddy refuge, other species are seen from time to time. Several White-fronted and Snow Geese

➤ Most of the avian visitors are Canada Geese, but many other birds can be seen here, including some that are rarely observed in this part of the country



➤ Because protection is given the wild birds, they enjoy perfect confidence in their surroundings—until a strange dog or some unaccustomed activity sends them flying

have been observed, as well as Hutchins's Geese. Nine Blue Geese had arrived by October 29 last fall.

Various ducks winter with the geese. The Gaddys have seen Black Ducks, Ringnecks, Mallards, Shovelers, Redheads, Green-winged Teals, Pintails, Baldpates, Canvasbacks, Ruddy Ducks, Blue-winged Teals, Coots, and Grebes. But perhaps most astonishing, because only one other example appears to have been reported from North Carolina, was a Cinnamon Teal, a western bird, whose presence was vouched for by two competent bird students besides Mr. Gaddy.

During the past season, records have been broken. The first geese—a group of seventeen—arrived earlier than ever before, on September 22. By October 29 an estimated 3000 had arrived—the largest number ever to have gathered during October. By November 21, there were at least 5000.

One Barnacle Goose, a European bird, came last November. Dr. Broley, the famous eagle bander, who also vouched for its identity, stated that it was the first one he had ever seen in all his travels.

Shortly after Gaddy saw that his pond was definitely established on the Canada's Duncan Hines list, the U. S. Fish and Wildlife Service set up a banding cage at one end of the pond. As many as 100 geese have been trapped for banding at one time. Nearly 500 of them were banded in one season. Many of these geese at the Gaddy pond have been found wearing bands of the Jack Miner Sanctuary in Kingsville, Ontario.

Gaddy tells a story of banding a number of geese on January 12, 1945, after which some of the birds, still terrified, took flight. Four days later, two of the banded birds were shot in southern Illinois, 500 miles away. (Canada geese in flight average 30 to 50 miles per hour.) This was curious, not only because of the distance but because of the direction. The unfortunate geese had traveled 500 miles westward at a time of the year when they were supposed to be permanently settled in the wintering areas.

During the banding operations the geese were weighed and found

➤ Some of the geese weigh as much as 11¾ pounds. They eat 1200 to 1500 bushels of corn in a season

▲ WHEN THE BIRDS LEAVE in March, a quiet descends over the Gaddy farm, but there is always excitement preparing for next season's winged pageant

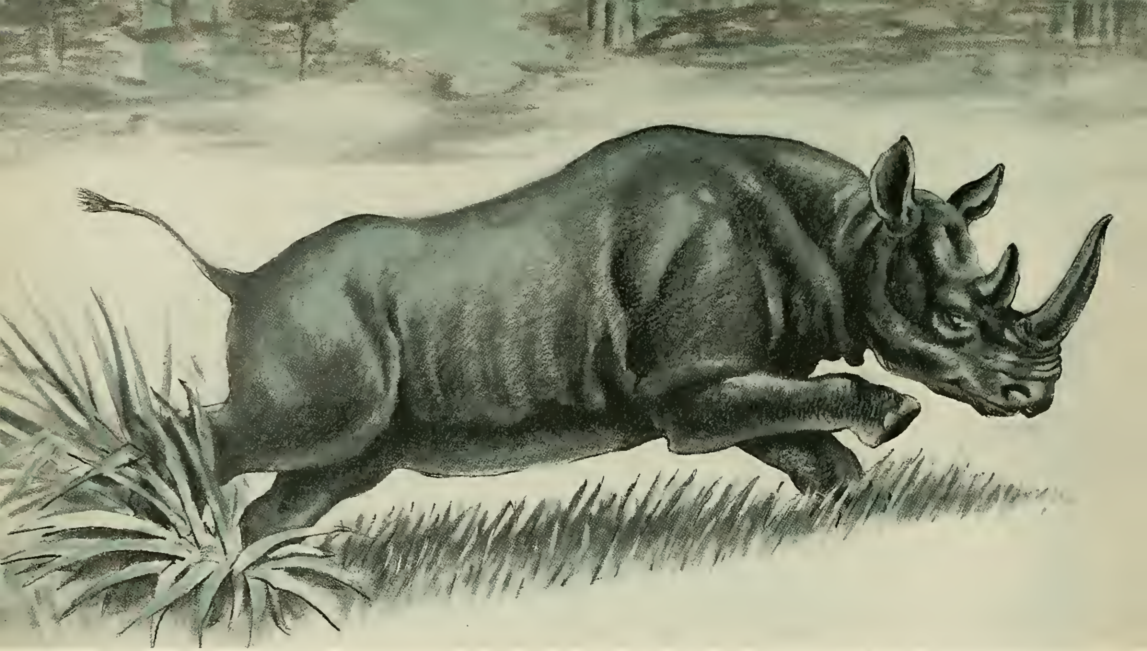
to average 9½ pounds, though some weighed as little as 6½ and others as high as 11¾. Geese are apt to be belligerent when nesting. The nesting goose will allow a strange human to approach only so far; then it charges, hissing like a snake.

There are, of course, sanctuaries where Canada geese gather in much greater numbers than at the Gaddy farm, but the birds can be seen only through binoculars, and photography is difficult or impossible. At Gaddy's all the birds are concentrated in a three-acre area. The farthest birds are only a few hundred yards distant.

This no doubt accounts for the sanctuary's popularity. Visitors include school children, college students, bird-study groups, writers, photographers, conservationists, ministers, and even hunters who, of course, are minus guns. Some stay only an hour or two, others bring picnic lunches and make a day of it. They learn more in a day of close-range observation than they could in a week of watching the birds from a distance.

Both Mr. and Mrs. Gaddy visit their pond twice daily, though it is a mile and a half from the house. As we noted, they have long since lost interest in roast goose. They look upon these wild birds as their children. They eagerly await their arrival in the fall, and in spring they remain at the pond until dusk to say "good-by" to the restless birds.

When March has passed, there is a deep quiet over the Gaddy farm. The pond is empty except for a few crippled birds and descendants of the original decoys. A kind of sadness descends. The days drag until October when the geese return. But Mr. Gaddy has something to look forward to that is more exciting than his shotgun and hip boots. He finds greater satisfaction in having won the friendship of these majestic birds of passage.



Drawing by Museum Illustrators Corps

MONSTER of the Mist Forests

A heavy pause, a violent snort, a sudden turn, and the massive African black rhinoceros charged through the brush, downing everything in its path. Here, indeed, was nature's counterpart of the Sherman tank

By Ken Stott, Jr.

General Curator, Zoological Gardens of San Diego

TANGLED forests clinging closely to the contours of mist-shrouded slopes; ravines of blood-red rock; filmy plumes of water plunging into foaming and tortuous stream beds — this was the stronghold of the monster of the mist forests.

While I waited still and motionless, the guttural chuckle of a colobus monkey echoed through the jungle, and intermittently the throbbing call of a touraco emanated from some hidden perch. From the distance came the sound of the breaking of brush and the muted trumpeting of an elephant. Night was enveloping the East African forest with the rapidity that is typical of the passing of equatorial dusks and dawns.

Suddenly, from up the trail, muffled footsteps advanced, sucking and sloshing in the ooze. A blustering wheeze of uncertainty rent the air. Then a heavy form detached itself from the forest and the increasing gloom.

As it stepped into the clearing, four yards of massive, wrinkled power and two menacing horns became apparent. This was the monster himself—the African black rhinoceros!

Once he had emerged from the forest, he broke into a swaggering trot and made his way to the waterhole with all the grace of a Sherman tank. He stopped on the bank and lifted his head to sniff the air cautiously. Eventually satisfied that all was as it should be, he lowered his head and began to guzzle his evening drink.

The resulting sounds were scarcely indicative of proper table manners. He slurped and gulped with all the gusto of a truck driver over a cup of steaming coffee, and when at last he had slaked his thirst, he did the truck driver one better. He wallowed in his cup!

Gingerly, he waded into the water and lowered himself into the mud, and when half-submerged, he began to thrash with gay abandon. Legs, head, and tail were tossed in every direction as he rolled from side to side on his back.

Then after a moment he stopped, sat up on his haunches, and looked about himself in a most apologetic manner. He rose to his feet and, as daintily as before, tiptoed from the wallow to begin his nocturnal foraging.

It was now quite dark. Only the light from the moon overhead lent a shadowy detail to the landscape. The rhino, a vague black form, lumbered about the clearing, pausing now and then to nibble at the leaves of some low-growing shrub. In the darkness he resembled an animated boulder, and as such he was not particularly exciting. The time had come to take matters into my own hands.

With a flip of the thumb, I switched on a powerful flashlight, and the rhino stood motionless in a pool of light. Had I been on ground level, this action would have been nothing less than foolhardy, but here in the lofty security of Treetops Inn* I had ample reason to feel safe. Treetops, a glorified blind constructed in the branches of a giant jungle fig tree, is an ideal place for even the most timorous of sightseers to view Africa's most cantankerous game without an iota of danger.

After a moment of immobility, the rhino was galvanized into action. He squealed at the top of his lungs and, wheeling frantically, tried to escape this terrifying blaze of unknown origin. All at once he charged, first one way, then another, pausing between charges to squint at the light with his weak little piglike eyes.

Finally, when he could stand it no longer, he barreled out of the clearing as fast as his stubby legs could carry him. With no attempt to find one of the several trails that converged upon the clearing, he merely made his own as he galloped along, pushing down anything and everything that stood in his path. Long after he had disappeared from view, I could hear his panic-stricken squeals and snortings and the violent crashing of brush.

Incredible though it seemed, this mighty beast was scared stiff—the same animal that has been known to derail locomotives and overturn trucks. With my own eyes, I had only a short time before seen a rhino rout a herd of the dread African buffaloes. It was hard to believe and even harder to understand.

The answer came a day or so later from a veteran trapper, Hugh Stanton.

"The rhino's really a very mild-tempered fellow," he told me, and when I appeared skeptical he went on to explain, "He possesses notoriously bad sight. Consequently, the old boy's got to be constantly on the alert, depending almost entirely on his senses of smell and hearing. Any unfamiliar sound or scent sends him into uncontrolled panic. Frequently when he appears to be charging, he actually thinks he's running away from the danger."

"This," I remarked, "must be very comforting to anyone who happens to be in his path."

Stanton ignored my sarcasm. "Of all the animals I've collected for zoos," he continued, "I'd call the rhino by far the most responsive. I've found it possible to tame a full-grown rhino within a month of his capture. It's all a matter of mutual understanding. Treat him gently and quietly and you'll have a perfectly reliable pet."

All of Mr. Stanton's opinions may well be true (and I for one would hesitate to contradict them), but a rhino remains a formidable adversary in the bush. Rhinos are most active during the hours from dusk to dawn, at which time they are difficult to discern and thus avoid, being as dark as the night itself. During the day, they usually retire to the depths of the forest or, if they are plains-dwellers, into the densest thornbush thickets. Once they have entered the vegetation they become almost invisible. The nondescript gray of their leathery hides serves as excellent camouflage. Thus, an innocent traveler can stumble upon a rhino before detecting its presence, and in the resulting encounter it is sometimes difficult to convince the beast that one's intentions are harmless.

The black rhino is found in a variety of habitats: the lowland deserts, the upland bush and plains country, and even in the forested mountain ranges; but he is commonly looked upon as a denizen of the first two only. This may be due in part to the fact that game photographers, because of the nature of the forest habitat, have been forced to limit their activities to the other two, where the light and climate are better. But even fairly authoritative natural history texts sometimes dogmatically restrict the distribution of the black rhinoceros to the drier, open terrain of Africa south of the Sahara. Regardless of the cause, the black rhino, as far as the layman is concerned, has erroneously emerged as a creature of bush and desert only. Nonetheless, it is in reality every bit as much at home in the densest of East African mountain forests, and in some such areas it is extremely abundant. Hunters maintain that the mountain-dwelling rhinos develop longer horns than their lowland kindred, but otherwise they differ neither in appearance nor habit.

Wherever it occurs, the black rhinoceros is primarily a browser. It feeds on succulent aloes and euphorbias, as well as on the leaves of acacias and other scrubby trees. It is innately fond of wallowing, perhaps because of the hordes of insect parasites that dote upon it. Even the omnipresent tickbirds seem utterly incapable of coping with the situation. Although the rhino is a great wanderer, it is seldom found far from water; and according to native lore it possesses a remarkable memory for local geography, which guides it unerringly from one watering and wallowing place to the next.

Sociologically speaking, the black rhino is essentially a lone wolf. Only during the breeding season does one rhino customarily join forces with another. In but a single instance was I privileged to observe more than a solitary bull or a mother and calf at one time. In this case, a father rhino apparently wished to have a hand in the rearing of his offspring.

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* See "Treetops," by Lt. Col. and Mrs. William J. Morden, NATURAL HISTORY for May, 1949.

The scene was in Kenya's northern desert, near Wamba, and I watched it from the vehicle of Hugh and Jane Stanton, who were conducting me on a brief tour of the Northern Frontier District.

They made a tender sight, this rhino family. Mother, father, and half-grown baby stood testing the air suspiciously about three hundred yards away.

Stanton howled gleefully, "Now for some real sport!"

Somehow, I didn't quite like the sound of that. I had a very uncomfortable feeling that Stanton's idea of "real sport" might differ from mine.

He started the car, turned it around, and headed toward the rhinos. They stood their ground for a minute, snorted audibly, then scattered as we drove into their midst. We stopped and they stopped, one on each side of us and the third in front. Once again we began to move, and when we started, they started, this time converging upon the car. It was the beginning of a wild game of tag among the "four" of us, and it was one in which I did not care to be "it."

The three leathery, armor-plated monsters presented a thoroughly unpleasant picture as they rolled toward us from their separate directions, and the thought of the picture our vehicle might offer if they reached us was even worse. Apparently Hugh considered the same possibility, for he slammed his foot on the accelerator with a vengeance.

Off we went, with the rhinos on our tail, about a hundred feet behind us. Finally, they appeared to be thoroughly tired and stopped short in their tracks. Wheeling the car around, Stanton drove toward them again. At about eighty yards, he turned the car sharply to the right and, slamming on the brakes, switched the motor off.

"There's a picture for you!" he shouted.

I had completely forgotten about the camera in my hand and, at the moment, taking a picture was the last thing in the world I wanted to do. The rhinos, snorting and pawing the ground, were obviously on the verge of a charge.

"Let's get out of here. The heck with photography!" I yelled back.

Stanton shook his head firmly. "Not until you've taken your pictures."

I swore at Stanton, I swore at the rhinos, and I swore at the camera, but apparently I had no choice in the matter. I pointed the camera at the rhinos and without the slightest hope of getting a decent exposure (and caring not in the least) I began snapping pictures. Then all at once, the rhinos charged!

Mr. C. B. Perkins, one of my coworkers at the San Diego Zoo, has often sarcastically observed that I create the impression of existing in a perpetual state of imminent danger, regardless of where I am or what I am doing—and perhaps he is not without some justification. I wish, however, that on this occasion he might have shared in the adventure (and I vaguely remember wishing it at the time). Even now I do not like to imagine what might have happened had our engine failed or had we dropped into one of the all too numerous pig holes.

The rhinos throttled toward us like a trio of jet-propelled steamrollers, and I held my breath while Stanton ground on the starter. After a hysterical sputter, the car jerked into motion and away we went at a speed of nearly thirty miles an hour. The rhinos followed close behind, with their wicked horns aimed at

▼ The menacing horns of the black rhino are more dependable than its eyes. Notoriously bad sight keeps the animal on the alert, and any unfamiliar sound or scent will send it into uncontrolled panic

▲ WALLOWING in the mud is great sport for the rhino—and possibly great necessity. The hordes of insect parasites that dote on the beast seem unable to cope with this activity

our rear bumper. We veered to the right to miss a boulder and swerved to the left to avoid a thicket, all the while heading for the road. The rhinos meanwhile had begun to slow down and, just as we reached the road, they lost interest in the chase and dove into a thicket.

As we resumed a normal speed, the color (or lack of it) on Stanton's face gave me a certain degree of comfort. Mrs. Stanton, who had remained tensely silent throughout the entire episode, now patted her brow delicately with a handkerchief and said, "Wheeeu! There was a moment there when I thought about pig holes." A moment! I concluded that any remarks I might make would be better left unsaid.

There is no more dutiful a parent than a mother rhino. She sometimes keeps her baby with her for several years—long after it is quite capable of fending for itself. Only a very young rhino is in danger of being preyed upon by other beasts and then only by lions. But the mother rhino looks upon her child as a precious but completely helpless infant, even when it is almost as large as she. Any cause for alarm, and she moves in front of the baby, daring the intruder to come one step nearer her beloved charge.

Other than man, the black rhino has few enemies. However, one notable exception, or so legend has it, is the elephant. Professional big game hunters insist that the two are deadly foes and that the elephant invariably emerges victorious from any conflict between them. A rhino, it is said, will never remain in the presence of an elephant. This seems open to question since on several occasions I have watched specimens of both species drinking from the same small water hole without the slightest indication of incompatibility.

The reactions of a rhino to other forms of animal life is entirely unpredictable. Sometimes it may drink or forage amidst a group consisting of several different species of animals and yet appear oblivious to their proximity. On other occasions it obviously wants the area all to itself and makes no bones about the matter. Whether this contradiction in attitudes is due to individual variation in disposition or merely the momentary state of the mind of the beast, I do not know.

One evening I watched a rhino charge directly toward a herd of buffalo, scattering them in all directions; and in another instance, a female rhino and calf sent a group of ten giant forest hogs scrambling away from a water hole. The rhinos were not content to drink until the forest hogs had entirely abandoned the clearing in which the muddy pool was located.

Numerically, the African black rhinoceros occupies a regrettably precarious position, and it has disappeared altogether from regions in which it was once common. That its numbers have dwindled so rapidly is due in part to the ravages of trophy hunters, in part to the inevitable encroachments of civilization, as well as to systematic slaughter of game of all types in the current and perhaps misdirected campaign to control sleeping sickness.

It is not inconceivable that the day will arrive when the black rhino has been entirely eradicated in the more open and accessible parts of its range, surviving only in the tangled mountain forests, which now constitute but a small part of its native haunts. Barring the removal of the jungles themselves, the black rhino may survive there almost indefinitely—a relic of the distant past, an awesome and incredible monster of the mist forests.

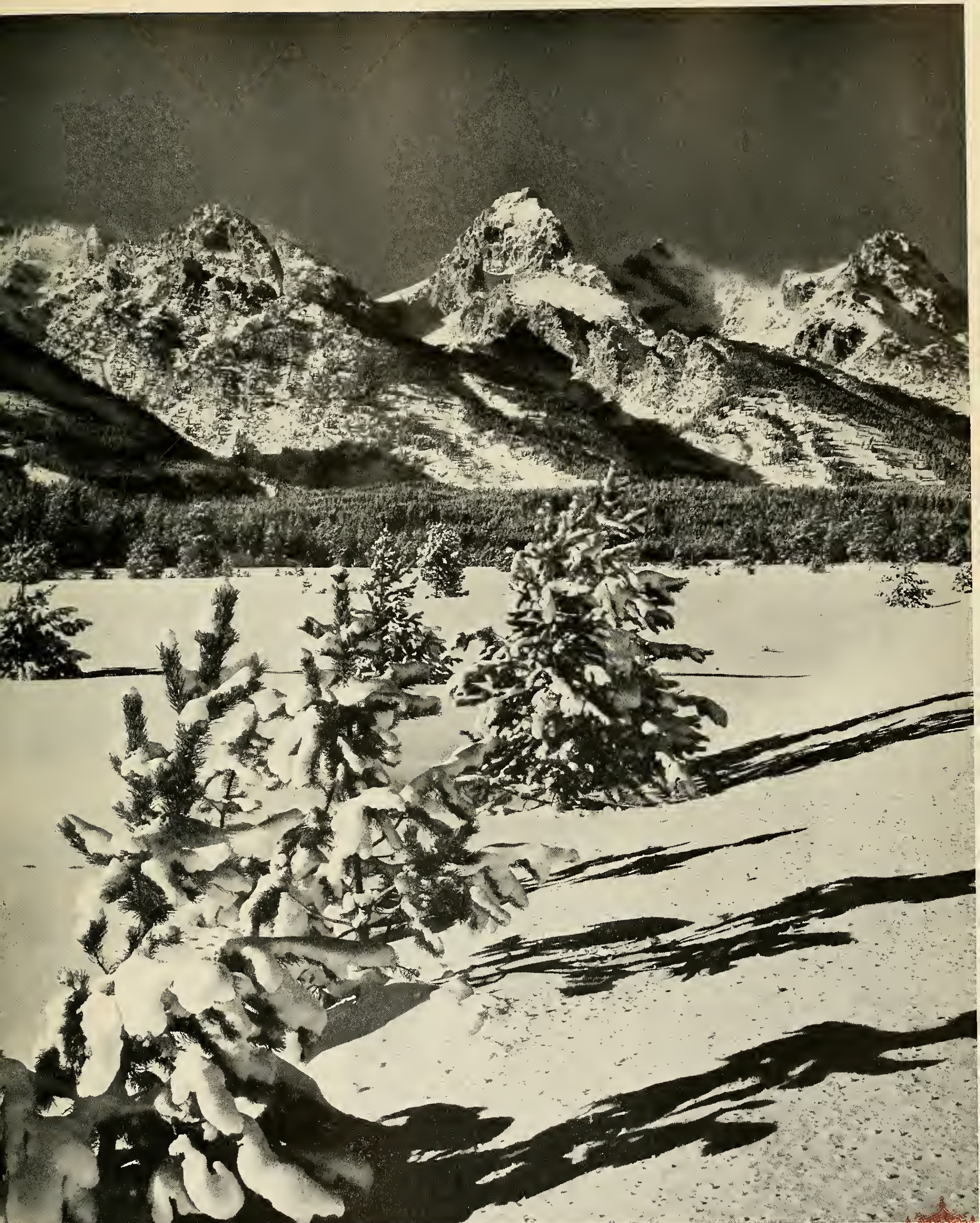
▼ THE BLACK RHINO is essentially a lone wolf, and only during the breeding season is it customary for one rhino to join forces with another

Photographs by Hugh R. Stanton

▲ A SKIER'S VIEW of Jackson, Wyoming, with the Grand Tetons rising in splendid array against the sky line

▼ YOUNG NAVAJOS, regardless of weather, ride their ponies over the lunar landscape of Monument Valley to herd the few horses they own

▼ ELK, coming down to a feeding station in Lamar Valley in Yellowstone Park. Like all of our National Parks, this is an animal preserve



▲ THE GRAND TETONS, lifting their snow-laden forms above the smooth valley of Jackson Hole. Grand Teton (*center*) is 13,766 feet above sea level, and its neighbors lift high enough to share its glory

▲ THE "KONO" moored in a cove near camp. Before the accident, she brought all supplies from Port Moresby and Daru and dropped stores for nearly four-score men in the expedition's camps in the mountains. Her capsizing at Port Moresby occasioned the rafting adventure

➤ THREE RAFTS NEARLY FINISHED for the journey to civilization. Rand, in the foreground, directs the stowing of his collection of birds. The built-in fireplace is in the immediate foreground. The author's raft is already equipped with its tent. In the middle is one of the "boys'" rafts

Raftin

The story of a party of white men and their native Papuan helpers who journeyed on rafts hundreds of miles down a swift and almost unknown river in New Guinea

By G. H. H. TATE

Curator, Department of Mammals
American Museum of Natural History

All photographs by Archbold Expeditions

THE 1936-1937 Archbold biological expedition of the American Museum of Natural History had been in New Guinea but a few months, and 5 of its members with 75 Papuan natives were in the final stages of an attempt to reach the very heart of the great central highlands at the head of the Fly River—when the accident happened. The amphibian plane that had carried us into the interior hundreds of miles from our base at Daru, and afterward acted as aerial ferry and supply ship, capsized at her moorings in Port Moresby harbor. Word of the disaster reached us by radio, together with assurances that a rescue launch would be sent upriver as soon as obtainable.

Our upriver party comprised the ornithologist A. L. Rand, in charge; L. J. Brass, botanist; Michael Healy, police officer; Alan Willis, in charge of native labor; and the writer, who besides collecting mammals and invertebrates operated the radio set. A few weeks earlier we had divided into an advance party cutting track up the forested, rain-soaked mountains and a collecting party stationed at the foot of the mountains. At the time of the crisis Willis, Healy, and I, with most of the "boys," were in the advance group almost a week's walk beyond the camp where Brass and Rand with their helpers were at work.

The prospect was alarming chiefly because our mountain party had food for only nine days, and the weather was so stormy we could not be sure whether extra supplies could be flown in to us. Flying in those poorly mapped mountains in such weather was extremely dangerous. However, a chartered plane flew over a few days later and through an opening in the clouds spotted one of our camps and dropped additional food. Meanwhile the group at the foot of the mountains had picked up the bad news. It was then reluctantly decided that as there was no longer any way to supply the advance group the upland work must be abandoned. We had but one way to leave: the mountain group must walk back to the lowlands camp, and rafts must be built there so that the entire party could float down the river.

I took a gang of boys and the radio set and moved out first, followed a few days later by Willis and Healy with the rest of the hired natives. It was a nightmare trek amid almost

own the Fly River

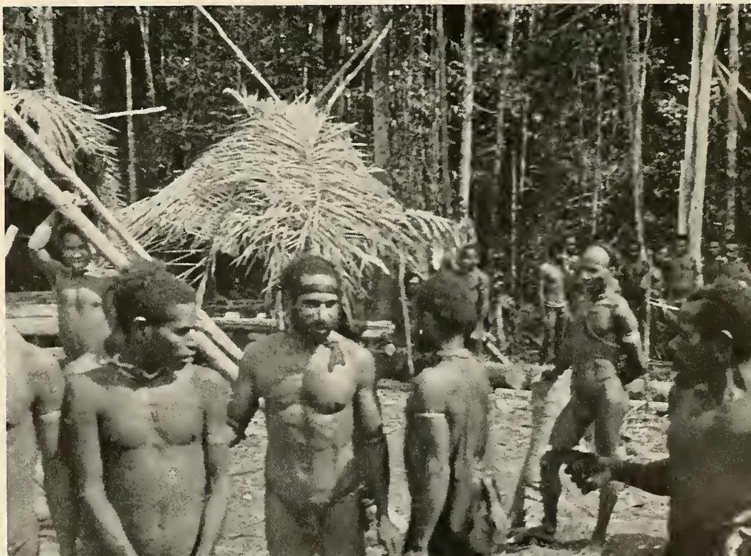
constant rain over the most rugged, densely forested terrain imaginable. Suffice to say that we got there and found Rand and Brass with every available man already felling trees with which to build rafts.

The main camp in the lowlands stood in a tiny clearing amid tall forest, at the edge of the Palmer River, a principal tributary of the big Fly River. The Palmer was a stream 70 yards across, unpredictable and full of vagaries, rising and falling a score of feet with the changes of the weather in the mountainous hinterland. The wild native bushmen had come to tolerate our presence to the extent that the lives of our "boys" were reasonably safe provided they went about in pairs, one of them carrying a gun. But to ensure perfect safety at that time of the emergency, the boys were sent into the forest to cut great logs for raft building in groups of half a dozen, with an armed policeman in charge. Meanwhile our precious collections of zoological and herbarium specimens, comprising hundreds of preserved birds, animals, insects, and plants, were packed, and a beginning was made of dismantling the camp.

For days the forest echoed to the sounds of chopping and the periodic crash of falling trees. At intervals a boy came riding downstream astride one of the huge logs, guiding it with astonishing skill by means of a paddle improvised out of a stick. Each tree trunk arrived equipped with a "bush rope"—fashioned out of the climbing palm known as *Calamus,* the rattan of commerce—tied tightly to it to act as a mooring rope.

The logs were assembled at the mouth of a small stagnant creek near camp, which had been selected as

▼ THE "A-WIN" TRIBE of the Palmer River, coming to trade natural history specimens for beads and pigments with which to adorn themselves. It was one of these natives who stood in the deserted camp beating on a kerosene can when the raft flotilla drifted past. The palm covering over the tent is a sunshade

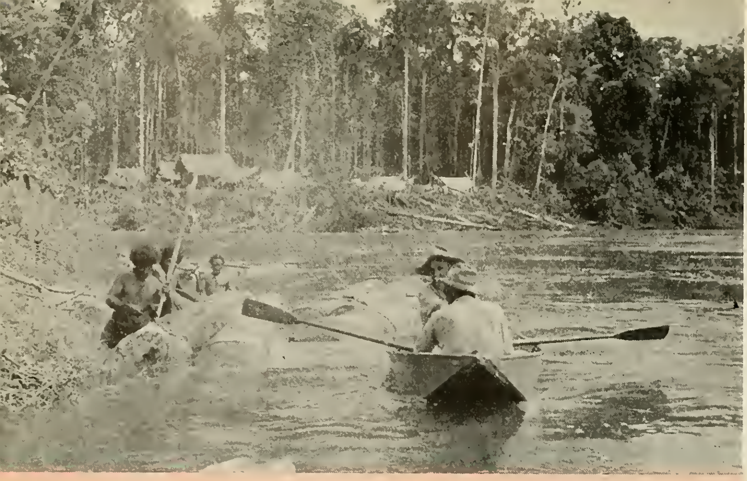


the spot best suited for construction of the rafts. Several boys were detailed to collect quantities of "wairo" (*Calamus*), with which to lash the yard-thick logs together. Building operations started. The tree trunks were lined up parallel in groups of four and were held there by means of poles thrust deep into the river mud, while band after band of tough-fibered bush rope was looped around them and pulled up taut. Strong cross poles were bound solidly into place above the float logs, and on top of them again was tied a floor made of split sago palm trunks, the whole built up to give the deck surface a clearance of about one foot above the water. Not a nail or any other piece of metal went into the construction. The biggest raft was estimated to weigh close to six tons. When completed, it measured 11 feet wide and some 25 feet long. The smaller rafts attained only about three quarters of the dimensions of the largest; their cargo-carrying capacity was, of course, very much less.

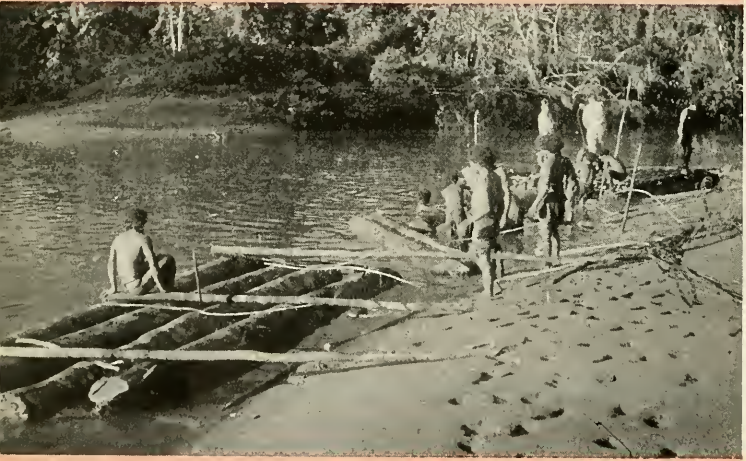
Each night a police guard was stationed to watch the precious shipyard lest some mischievous bushman cut our hard-won navy adrift.

In something more than a week, the work was done. Twelve sturdy craft, moored fore and aft, lined the water's edge. At the rear of each was a quantity of firewood and a built-in fireplace for cooking made of a large shallow box filled with sand. Each raft was also equipped with a steering oar and half a dozen paddles. The order was given to embark.

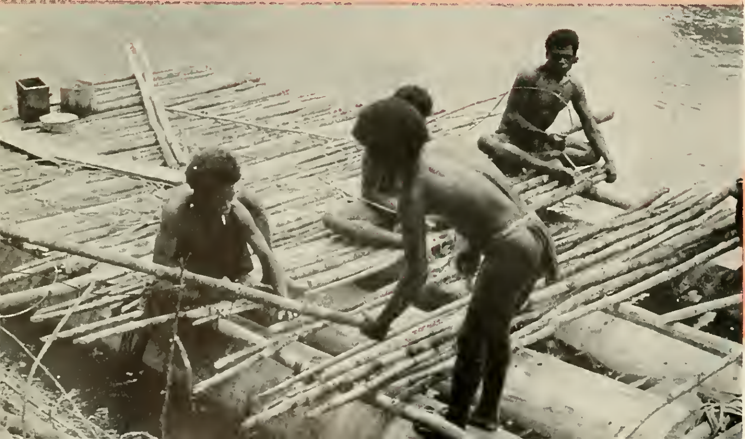
When an unknown river must be traversed for an undetermined number of days, it is well to take every precaution and lay plans with the utmost care. Our party hoped to be able to keep together so that if any raft got into difficulties, others might come to its assistance. Each day we would start out as soon as possible



▲ An early stage in raft making. The boys rode the logs down the river and assembled them in spots sheltered from the current. Healy facing the camera, Rand at the oars in the folding dinghy



▲ Lashing the float logs together with heavy crossbars. The bush rope used was a climbing palm, *Calamus*, locally called *wairo* and known to Australians as "lawyer cane"



◄ After the main lashings and crossbars were completed, a second series of poles laid lengthwise formed the foundation of the deck of poles or split palm stems. The deck stood at most about one foot above the water level after daybreak and travel until an hour before dark. A small collapsible dinghy served to keep up communications.

Five of the craft were captained by white men, the other seven by the native police sergeant, the cook, and selected boys. The crews were carefully chosen and assigned. Supplies of food and equipment were stored near the center of each raft and covered with tarpaulin so that the heavy splash of water from rapids or whirlpools would be less likely to reach them.

Each white man arranged his raft and equipment to suit his tastes. Each also assumed responsibility for his own collections. As I had charge of the radio set and power supply, with a small stock of gasoline for the motor, I was assigned the biggest raft. Each man had a sleeping tent small enough to be erected on the forward deck. This, with a strip of canvas shading the deck just in front of the tent, made a combined sleeping place and piazza from which, seated in his folding canvas chair, the skipper could survey the whole river. The cook, the crew, and the man at the steering oar lived at the rear. So much for our preparations.

During the last few days, the forest people, the "A-win," had been gathering. They divined what was about to happen, and they began to assemble so as to be first into the deserted camp to gather abandoned treasures such as empty cans, sacks, boxes, and gasoline tins.

One by one the rafts pushed off into the deep, swirling current, for the Palmer River was once more rising as a new flood descended from the cloud-hung mountains. The crew of each raft paddled hard for midstream so as to avoid being carried into the low entangling branches that overhung the banks.

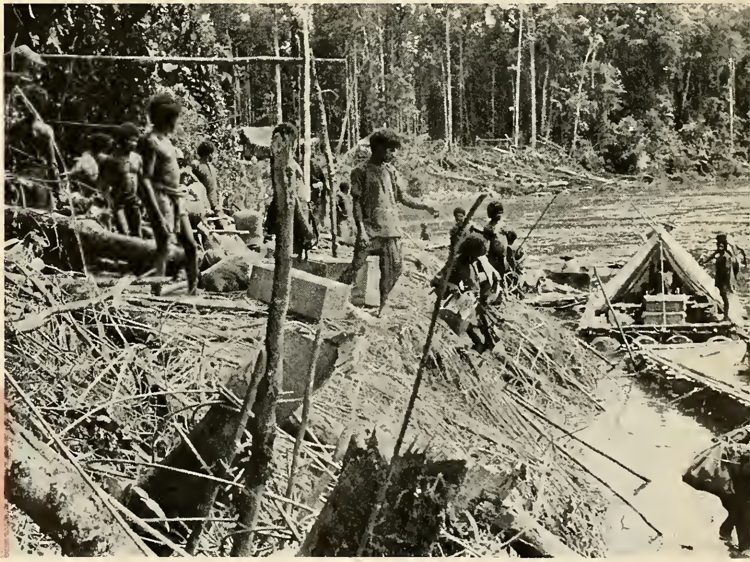
As we swept past the camp we had occupied for months, we saw a bushman standing there, his filthy hair plaited with straw, his nearly naked body daubed with yellow paint—obtained from us in trade for animal skins. He shouted unintelligibly and beat violently with a club upon an old kerosene tin. A few seconds later a bend of the river cut him off from our view. Bad weather had been threatening. It began to rain.

Every man concentrated tensely upon the behavior of his raft and its navigation. The helmsman found that he could hold the head of the craft downstream with comparative ease. But we found it very difficult to move nearer or farther from the bank. A decision had to be taken, as we approached each turn in the river, whether to guide the raft to left or right. So ponderous a mass of logs surging along on a seven-mile-an-hour current required hard paddling on the straight stretches in order to have it in position for the next curve. In places, rocky headlands pushed out into the stream, setting up back-eddies whose effects upon the rafts varied from mere annoyances to really dangerous whirls.

Sometimes the river widened enormously. At such places huge, slow-moving eddies existed, whirls a hundred yards across and perhaps three times as far up and downstream. They helped us work in from midstream to the bank when it was time to tie up for the night. But they also held us tenaciously when we wished to leave in the morning. My large raft was so unwieldy, its inertia so tremendous, that despite violent efforts, the paddlers managed to drive it out of one of these eddies only after two tries—and each complete circuit of the backwater required just twenty minutes to complete.

When a rapidly flowing river rounds a curve, the current moves slowest close to the inside, fastest at the extreme outside. The approach must be made about halfway between the inside bank and midstream. If a raft came too near the inner bank, it was likely to be drawn into an eddy. But it was far worse to approach on the outside. The velocity of both water and raft increased alarmingly, and the vast momentum generated by the tremendous weight of the timbers tended to drive the craft tangentially outward, perhaps to strike against rocks and break apart.

Such an experience almost befell one of the convoy. The crews of the rest watched in utter helplessness as, wholly beyond control, one raft



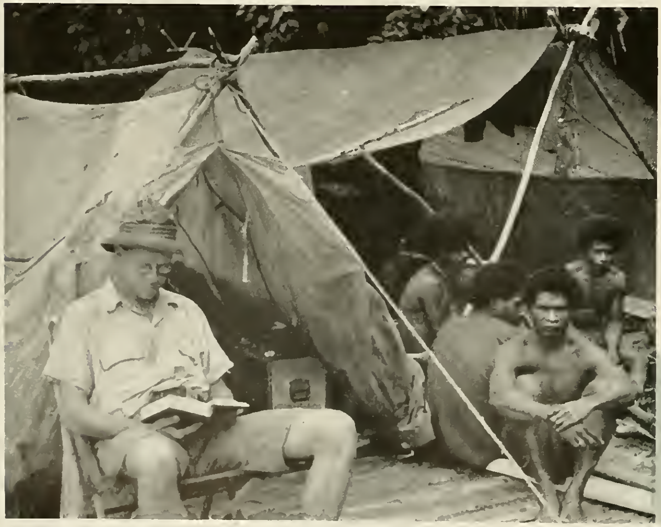
➤ AS THE RAFTS WERE COMPLETED, the "shipyard" became a veritable tangle of discarded bush rope. On several of the rafts small tents were erected. One raft, finished before the others, is partly loaded with supplies load of natives drove down the outside of the bend. The water seemed distinctly to pile up against the projecting cliff face. A huge, half-dead tree leaned low over the river, the tangled branches of its crown directly in the path of the ongoing raft. The next instant they struck it. Two of the men jumped overboard. The raft tilted sickeningly, and a great snag of wood plowed a six-foot gash through the tarpaulin. Then it swung clear. Fortunately, the river straightened out from that point, and the two swimmers climbed on board again. A few hundred feet below, when they tied up to the bank in a patch of slack water to check up the damage, they found that by something approaching a miracle nothing but the torn cover had suffered injury.

Another raft met with a minor accident by getting into water too shallow for its draft. The river had shallowed rather abruptly, and the swift current thrust the rectangle of logs relentlessly upon a bank of grating gravel, much to the detriment of the lashings that passed under the logs. Quite half the bush ropes were cut through, and most of the others badly frayed. The risk that the raft might go to pieces appeared so great that we decided to put into a quiet cove at once, cut new lashings, and make repairs. The lead raft was tied up at a suitable place on the inside of a wide sweeping bend where the current ran less violently. The crew grappled with overhanging vines. Chopping violently with their cutlasses, they carved an entry and withdrew their tent-covered craft almost from view. Raft after raft followed the lead of the first one, each coming to rest a few yards downstream from the one that had preceded it, until all twelve were snugly moored in a compact row, reasonably safe from disturbances by floating driftwood.

Half a dozen boys, under the police sergeant with his rifle, were dispatched to cut a supply of bush rope for reinforcing the lashings of the raft that had scraped the shingle bar and for stiffening the construction of any others requiring it. Meanwhile, gangways were quickly extended from the rafts to the low bank as well as from one raft to the next. Cooks carried their pots and supplies ashore, glad to move freely after many hours of cramped quarters on board. As darkness grew in the forest, campfires gleamed here and there, picking out the great boles of near-by trees, the sheen of the boys' limbs, their great golliwog-like mops of hair, and the red of their ramis—the apronlike garments they wore instead of trousers. Such evenings are pleasant to look back on. While waiting for supper to be made ready, we five whites gathered together, cup in hand, taking the evening rum and water to wash down the quotidian quinine capsule. Events of the day were discussed. Cigarettes and a pipe glowed in competition with the erratic flashes emitted by cruising fireflies. A dull red glow in the sky, reproduced in the mirror-like river, alone served to recall the sunset. After supper, "notes" were written, and every man climbed under his mosquito net.

One day the party had started under perfect conditions, the weather fair, no cloud upon the horizon. But soon things changed. Rain had been falling heavily in the mountains, and presently its effects reached our raft convoy. For the rest of the day water fell in torrents, the surface of the river jumping and boiling under the ceaseless pelting of the downpour. Visibility was often less than 100 yards. Perhaps that accounted for the very poor place at which the rafts were tied up for the night; for when the rain slackened a trifle just at sunset and we could see where we were, we found ourselves lined along the outside instead of the inside of a bend and, as later investigation brought out, tied not to the true riverbank but to a low island, whose surface then stood only a few feet above our decks. As darkness fell the river began to rise again. A big flood was coming.

That night was an anxious one. The water rose steadily; the current grew stronger. Many additional *Calamus* mooring lines were set out from each raft. My own heavy craft hung swaying and trembling at the ends of no less than eleven such lines. And on every raft, boys were stationed with flashlights and long bamboo poles, ready to fend off the



◄ RELAXATION after the worst of the rapids had been passed: two rafts tied up securely on one of those few nights when the rains held off

➤ **The rescue ship.** The "Ronald S." may not be "a thing of beauty," but she appeared a wondrous vessel to the explorers when she chugged up the river to their last raft stop. She was a little crowded at times

drifting logs which the torrent thrust perilously close. The water continued to creep up inch by inch, while the raft crews chopped a way in among the sapling vegetation, in order to save us as much as they could from the direct pull of the current.

Presently the island was covered. An hour later the rafts, which drew from two to three feet, floated in over the top of the bank and were additionally secured by heavy stakes driven down all around them into the mud. Still the water level rose.

It must have been nearly midnight when a hail from the first raft warned us all of trouble. Only a few yards away a huge tree, torn from the bank far up the river, was driving past, roots foremost, as majestically as a ship. Just as it drew abreast its roots locked with some obstruction under water, and it hung, teetering for an instant while the river tore and raged through its branches. Just in time our boys, thrusting in unison with poles, stopped the inward swing which, had it completed itself, might have torn several rafts to pieces. The head of the tree was deflected outward toward mid-river. An instant later that danger had vanished in the darkness.

But the greatest trial of all came just after dawn. The men were resting, worn out by the night's vigil, the cooks were making shift to brew some coffee, and it seemed that the peak of the flood had passed.

Some of the crew of the last raft in line glimpsed what was coming and yelled to those up ahead to "look out." But it was too late. A tremendous, relentless crashing of saplings announced the approach of two gigantic interlocked trees that pivoted against each other with a kind of scissors movement. Crashing through the low screen of the island vegetation, they struck the leading raft and drove it with a terrible blow against the one behind it, and that in turn against the third. So violent was the shock that almost every mooring line in the row of rafts was snapped and the component logs of all the lead rafts were driven askew. A twist of the current drew the hinged tree trunks back to deep water, carrying our first raft pinched between them.

The crew of the front raft had barely had time to see what was swooping down upon them. All except two boys and Willis, who was captain, jumped over into the water. Those three were carried away down the river between the locked tree trunks. Their tent was torn down; they had no paddles and only a couple of poles to maneuver with. They quickly passed around a bend of the river out of sight. Two boys were at once sent after them in the dinghy with food, water, ropes, and paddles.

That incident marked the end of the struggle. The water began to recede. Every half hour its depth was probed. The current was still very strong, but we had to ease out into it a little so as to avoid having our heavy rafts come to rest on the top of the island, like Noah's Ark upon Mt. Ararat. It was almost sunset, however, before the island actually emerged. Sleep was never so welcome as that night.

In the morning the journey was resumed. Half an hour downstream the dinghy came alongside, the boy at the oars bringing a note from Willis saying that all was well. The raft had been freed from the big logs very quickly; they had repaired the lashing and repitched their tent; they were only a little way ahead.

Presently the already large Fly River converged with a tributary, also of great width. The current slowed to two miles per hour. A strong sea breeze rose in the afternoons, driving short, choppy waves up the long, straight reaches and sometimes dashing spray all over us. There was now depth of water enough for the rescuing schooner to travel without great risk of running aground. We tied up our convoy for good at an abandoned prospecting camp, the farthest upstream, to await the river boat.

Months later, as I stood on the bank far down the river, I saw one of our rafts again. It had broken adrift and was heading for the sea.

Curiosity

Caught a Booby

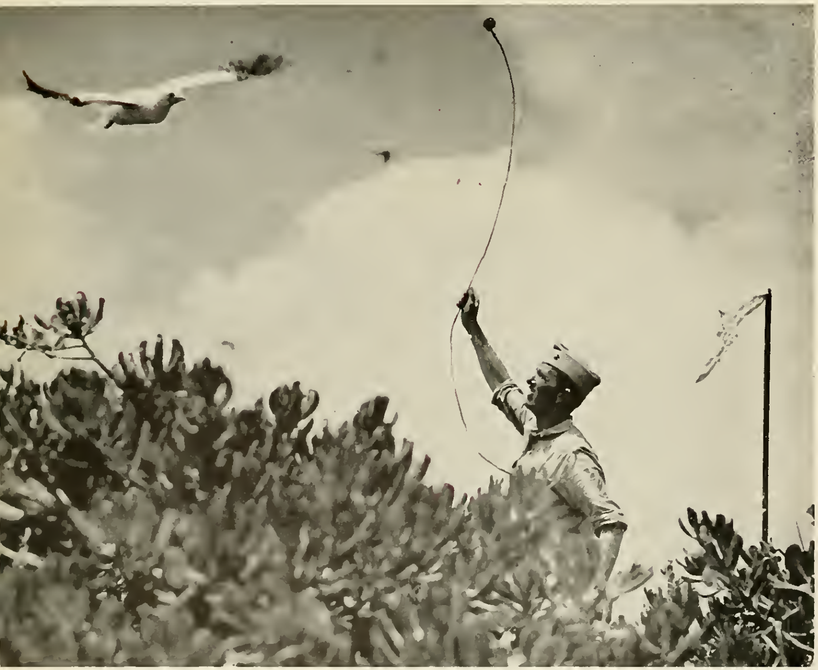
A method developed by early man has proved of value to starving men on life rafts

By Lewis Wayne Walker

Photographs by the author

DURING the Pacific war, the raft holding Eddie Rickenbacker and his two companions had floated for six days somewhere on the world's largest ocean. The men had had no food or water from the start. Their outlook for rescue seemed almost hopeless. And then on the seventh day, in a miraculous way, a bird circling the raft alighted on Rickenbacker's hat and furnished nourishment that kept them going for a few more days, enabling survival until search planes finally ended their floating ordeal.

Many other pilots can thank such chance captures for their survival, and yet the few pelagic birds that voluntarily landed on shoulder or outstretched hand were only the most unwary of the ocean flyers—probably young of the year, whose



▲ A Red-footed Booby approaches the white rag

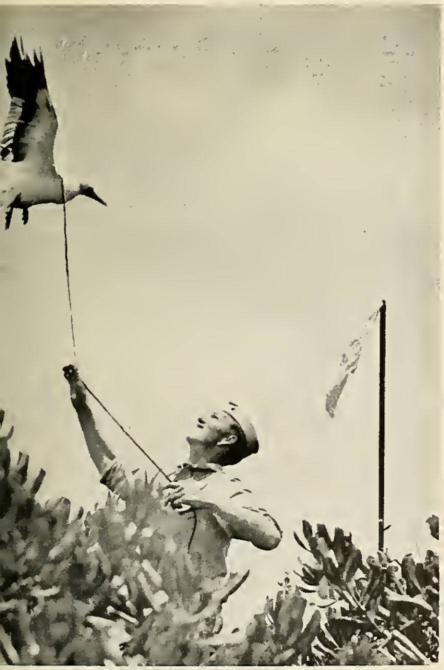
innate curiosity overcame their developing fear of man.

About 65 generations ago the Polynesian peoples migrated to the lonely, uncharted islands of the mid-Pacific in simple canoes with limited space for the storage of foods—vessels so frail that we might now hesitate to use them on our placid inland waterways. Their initial exploratory trips were based on wishful thinking—the hope that an island existed beyond the horizon. Weeks and months passed far from the sight of land, and the venturesome occupants were forced to subsist on the birds and fishes that they were capable of catching en route. However, in previous centuries of island hopping, first close to the Asiatic mainland and finally eastward to Hawaii, they had learned that many of the pelagic birds were extremely curious, drawn as though by a magnet to a fluttering rag in the breeze. This knowledge was passed orally from generation to generation and eliminated much of the element of chance in the capture of feathered foods on the high seas.

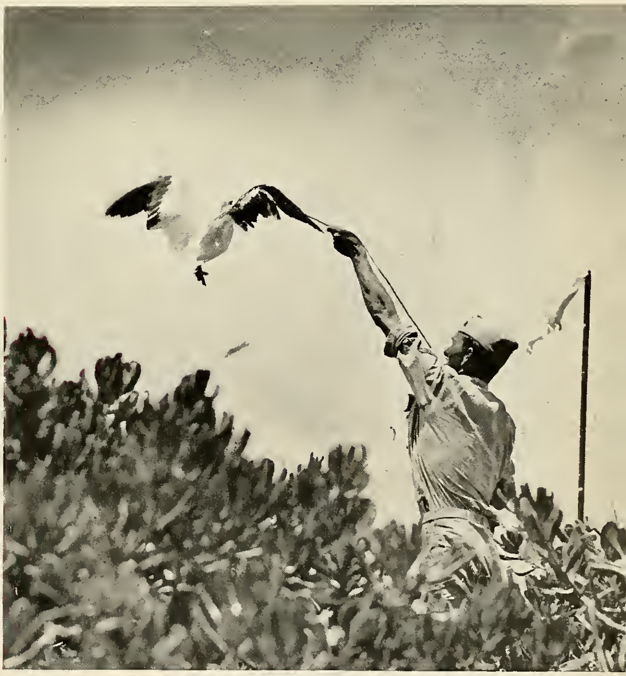
Throughout the centuries that elapsed since the inception of this simple Polynesian system of luring, some of the nesting islands have been invaded by man, and the birds have naturally lost some of their fearlessness. Generally speaking, the brazen, foolhardy birds have been eliminated and only the sagacious have survived to propagate their kind. This change was noticeably accelerated in the relatively few short years of the war. When the military forces first arrived at Midway, man-of-war birds, boobies, and terns would sit on their nests until pushed from their eggs. However, after two or three years of military occupation, this trusting nature was undermined, so that practically all of the nesters would temporarily desert when a human approached within a six-foot radius. But—and this was important to castaway pilots—the curiosity of the birds remained unimpaired.

During my tour in the Marine Corps, I was assigned to the Survival Training camp, and it was my duty among other things to test the practical utility of the theories

▲ **The wing** of the captured booby with the string in place



weighted string starts to wrap around its wing



▲ **The bird** is pulled to the ground

being taught to the pilots. The ancient history of the Pacific was literally picked to pieces in the effort to find and test any forgotten arts that might hold better promise of life for castaway or life raft occupant. If found impractical they were discarded, but if feasible they were added to the curriculum of the survival school. Thus bird-catching became one of my jobs.

Moko Manu Island, a few miles off the coast of Oahu, was chosen for the initial tests. Incubating birds of several species dotted the ground, but they moved off and took flight whenever they were closely approached. They would have been difficult to procure without slingshot or club. Then we tried the legendary system of the ancient Polynesians and tied a white rag on the end of a branch. When we allowed it to flutter in the breeze, boobies stopped their aimless circling and zoomed toward the waving material. With beating wings they slowed and hovered momentarily on its lee side, seemingly so entranced by the motion that they were oblivious to the human a few feet below. I started a pendulum motion with a string weighted on one end, and when the bird above was in the right position I swung the weight in the air, up and over the hovering form. The instant the string touched the outspread wing, the weight caused it to wind around, making the bird my captive. Primitive peoples in various parts of the world have used these so-called bolas for catching birds or other creatures, and many will recall having heard of them among the Gauchos of Patagonia.

On those first tryouts we made eight catches in eleven attempts, and this average was almost upheld when later experiments were made from a floating life raft. All of the birds were liberated after being unwrapped, but several of them swung around in a great circle to the decoy again—sure evidence that the birds called boobies are not misnamed.

ESKIMOS Glaz

▲ The sled is tipped on edge against a block of snow to expose the runner without unloading everything

heir Sled Runners

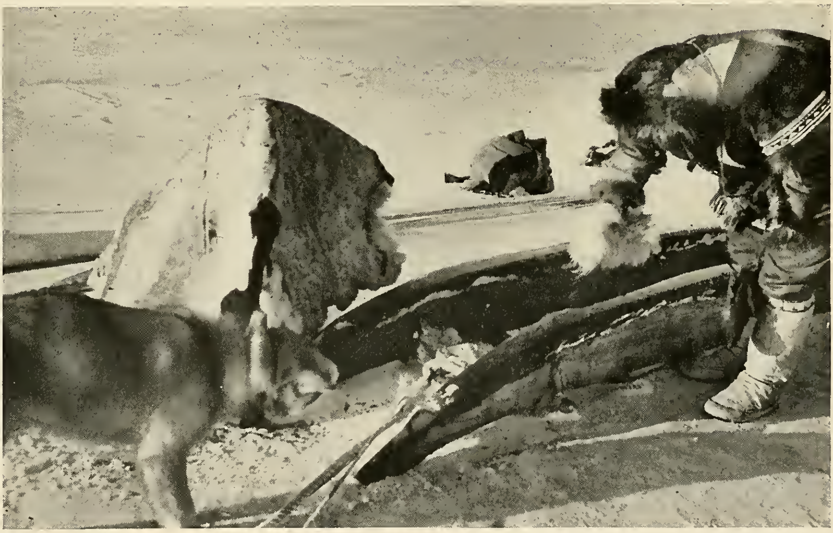
Lubricating oil would have little use in their wheelless life, but they have devised an ingenious method of overcoming friction

By THE REV. CANON J. H. WEBSTER
St. Andrew's Mission, Coppermine, N.W.T.
Photographs by the author

ESPECIALLY when the temperature falls far below zero, the dog sled plows through the dry snow as though it were going through sand, and the effort of pulling it is doubled or tripled. The Eskimo then needs a coating of ice on his runners. Ice will not stick well to wooden or bone runners, so a backing of frozen mud must first be applied. This is made by mixing earth, moss, or other material with water and applying it as a paste. Sometimes today, rolled oats or other porridge is used. The frozen mud is then smoothed with a woodworker's file or an old plane, and a coating of water is applied. Sometimes the water is warmed in the mouth and squirted on; sometimes it is heated in a pot and poured onto the bearskin mit that is used to smooth it quickly before it freezes.

On rough ground the ice shoeing often breaks off, and repairs have to be made on the trail. The Eskimo carries a little bag of water just for this purpose. This whole procedure—an arduous one under sub-zero conditions—is not merely a fad among a few sled travelers. It is a familiar routine to most of the Eskimos from Alaska to Greenland.

CARE IS USED in shap-
ng the backing of mud.
Note the smooth sur-
ace that is formed be-
ore application of water



▲ WHILE THE ICE was being applied with the fur "smoother," the runners were shaded from the April sun by a propped-up skin in this instance

➤ THE ONE WHO BENEFITS: a sled dog happy for the rest and grateful for a new pair of frictionless runners

MONTEZUMA'S

Pink Castle

The vast lands of the Southwest were theirs for the taking, but enemies forced hundreds of early Americans into a five-story apartment house—an architectural achievement but a prehistoric slum

By Nell Murbarger

WITHIN 150 miles of that famous corner common to four states may be found virtually every known cliff dwelling in America's Southwest. One notable exception is Montezuma's pink castle. Situated more than 200 miles from the above-mentioned point and almost directly in the center of Arizona, the Castle is far more widely known than most other cliff dwellings. It is easier to get to, and the public has long been conscious of it.

Passage of time has done nothing to diminish its appeal. During the travel year ending on September 30, 1948, more than 26,000 persons were stirred by the sight of this five-story apartment house, built half a millennium before Columbus set sail for the so-called New World.

No one seems to know who was responsible for giving this edifice its name. Certainly he was a romanticist. Not even a high-salaried Hollywood press agent could have devised a name with more public appeal. Montezuma's Castle! Montezuma, the picturesque and fabulously wealthy king of the Aztecs . . . and coupled with this, the word Castle—a holdover from fairy-tale days, a place of turrets and moats, of dark deeds and clanking swords and knights in shining armor. Surely the components of romance unfettered.

Climbing down into the levels of reality, however, we find that this building never was a "castle" in the sense of being occupied by one potentate and his court. Rather it was a prehistoric apartment house, tenanted by many families. As for Montezuma, there is no record that this Aztec leader ever set eyes on what is now Arizona. Most certainly he never dwelt in this cliffside aerie, because the place was built, occupied for a dozen generations or so, and abandoned to the winds all before Montezuma's birth in 1476.

Fortunately, the known story of Montezuma's Castle is no less romantic than the fanciful connotation of its name. In the first place, there is probably no more pleasant spot in all Arizona than the colorful Verde Valley in which it is located. Fed by numerous mountain tributaries, the tree-bordered Verde runs deep and clear and cold through a smiling meadowland. Here grass grows tall and green, and wild flowers bloom. Flanking the fertile valley are high, perpendicular cliffs of white limestone, brilliant red sandstone, and outpourings of dark lava. Stretching back from the rim of these cliffs are the high, wild plateaus of north-central Arizona; and still farther distant lie snowy blue ranges, densely forested with pines and fir and teeming with fish and wild game.

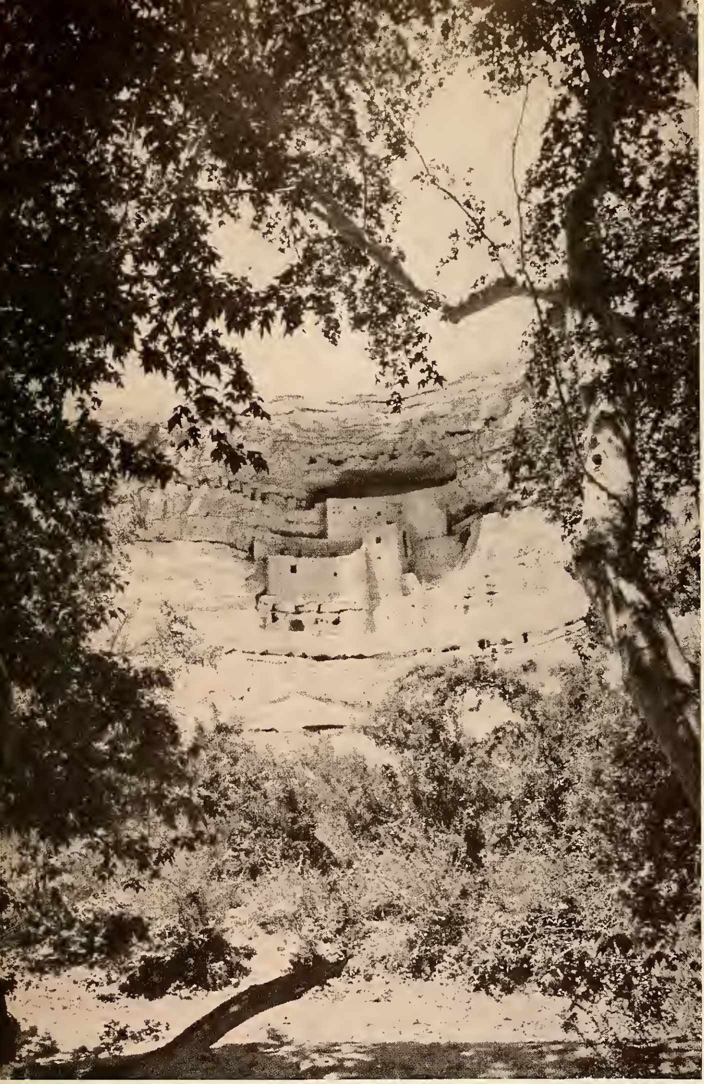
Southerners from the lands of the Salt River and the Gila moved into this attractive valley. As nearly as students of archaeology have been able to determine, this migration took place during the eighth century. While this was an age that saw nearly all the world's "civilized" men engaged in warfare of one sort or another, even then these Hohokam were a thrifty, industrious people—peaceful, well-fed agriculturists who knew the proper time to plant corn, squash, beans, and cotton, and how to lay the grade of irrigation canals so that the life-giving water of the river might be carried to the valley's farthest fields. Here they apparently knew freedom from persecution for 200-odd years.

In addition to their agricultural activities, these people made relatively good pottery vessels of two types—plain gray, and buff with red designs. They lived in one-room dwellings fashioned of poles overlaid with brush and reeds and plastered with mud, thus affording wind resistance and a measure of security from rain and snow. They were a distinctly rural people, having no cities or large centers of population. They lived a single family to a dwelling.

About the beginning of the eleventh century, trouble appeared on the scene in the form of nomadic hunting Indians—men most familiar with hunger and privation. Suddenly, the well-filled granaries and storehouses of the Verde—hitherto a source of both individual and tribal pride—became only centers for looting, and their defenders, candidates for death.

While methods of warfare, of offense and defense, have changed with succeeding generations, the principles have remained unaltered. Since the siege of Tyre, beleaguered men have sought strength in numbers. On the Verde this meant gradual abandonment of the single-family dwellings and ultimate construction of great communal tenements. By virtue of their location, on hilltops or in natural caves in the cliffsides, such pueblos were far more defensible than had been the individual homes.

It must have been with great elation that a group of the harassed farmers first realized the building



Nell Murbarger photo

▲ **Built** about 9 centuries ago, Montezuma's Castle was occupied as a fortress-home for possibly 300 years. Unsanitary living conditions may have contributed to its decline. The Aztec leader for whom it was named probably never knew of its existence.

possibilities offered by a great cavern-pitted limestone cliff that lay along the north bank of Beaver Creek. Here, beside this sparkling little stream, was farming land equal in every respect to that flanking the Verde, four miles distant. Here flourished wild berries, nuts, herbs, and medicinal plants. Here were wild animals for the hunting and trees ample for building purposes; and, most important of all, here was a sheer 150-foot-high cliff indented by great crescent-shaped pockets in which 100 men and their families might know safety and security. Thus was begun one of the Southwest's most magnificent building projects of prehistoric times.

Before that limestone haven on Beaver Creek could be made useful to man, it was necessary that a usable trail be forged up the cliffside. In some places this was done by gouging hand and toe holds in the solid rock. Other sections of the tortuous climb were spanned by ladders, consisting of crosspieces bound to poles by means of skin thongs.

When tribal workmen set about felling the great white-barked sycamore trees for ceiling beams and floor joists, it was necessary that they accomplish that gigantic undertaking by means of crude stone axes. They lopped off the branches and cut each timber to proper length to fit some individual requirement. Then followed the tremendous task of transporting these cumbersome, unwieldy beams up that sheer rock wall to the chosen niche.

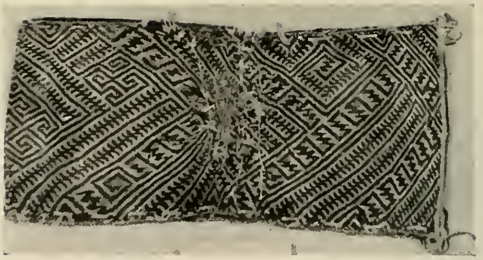
One by one the log timbers went up the cliffside, there to be fitted into notches laboriously hacked from the solid rock of the cliff's rear wall. Meanwhile, over the same trail, borne on human backs, were carried adobe plaster and mortar.

We know that when the project was completed, three distinct apartment houses had been erected within a half-mile section of cliff wall. Largest of these was a tenement six stories high, containing forty-five rooms. One hundred yards farther east rose a second communal dwelling of five stories and twenty rooms.

The six-story apartment was destroyed by fire and abandoned a hundred years or so later. The second in size—Montezuma's Castle—still stands, 90 per cent intact after 900 years. Its remarkable state of preservation is attributed to the great shelving overhang of rock which has served to protect it from the elements. It was lived in for 300 years. In the United States today, there are few buildings of white man's make that have been used for so long a period, even among the venerable Spanish missions of New Mexico.

During those three centuries the inhabitants of Montezuma's Castle lived through the Great Classic Period of pueblo culture. Although they never progressed into the use of metal, their stone tools and implements showed constant improvement of line and craftsmanship. Also, they made baskets of pleasing appearance and sturdy construction. They wove durable sandals and bags of yucca fiber. They made pottery

▲ THE PEOPLE of Montezuma's Castle made pottery in brown and red and gray types. These polychrome bowls were found in graves



National Park Service photos

▲ AN ANCIENT COTTON BAG from Montezuma's Castle, twelve inches long and woven by the "weft-floating" technique

in brown and red and gray types and traded with the Hopis and Indians of the Flagstaff area for white pottery artistically decorated in black. They made exquisite jewelry of turquoise mosaic and of seashells traded from the Pacific coast or Gulf of Mexico.

Perhaps the greatest of their accomplishments, however, was the highly-skilled manner in which they manufactured cotton cloth. We are often inclined to regard cotton as a relatively recent innovation, yet long before white man ever set foot within the province of Arizona and New Mexico—even as much as 1200 years ago—Indians of that region were cultivating extensive fields of short-staple cotton.

From their irrigated farms along Beaver Creek, the people of Montezuma's Castle and adjacent pueblos gathered their fluffy white harvest, ginned the bolls by primitive means, and spun the linters into yarn and sewing thread. This, in turn, was woven into cloth—some of it elaborately patterned.

Archaeologists, excavating Montezuma's Castle in 1923, uncovered a baby burial made more than five centuries before. The infant had been interred in his little blanket of hand-woven cloth, which still showed plainly the exquisite workmanship and the infinite care and patience of some loving woman.

A Glimpse at Yesterday

The opportunity to visit this wonderful place came to me last year in October. Equipping ourselves with a booklet, we set out on a journey of discovery. Interesting shrubs, trees, and archaeological features en route had been marked with numbered stakes, corresponding to numbers in the guidebook which served to interpret and explain.

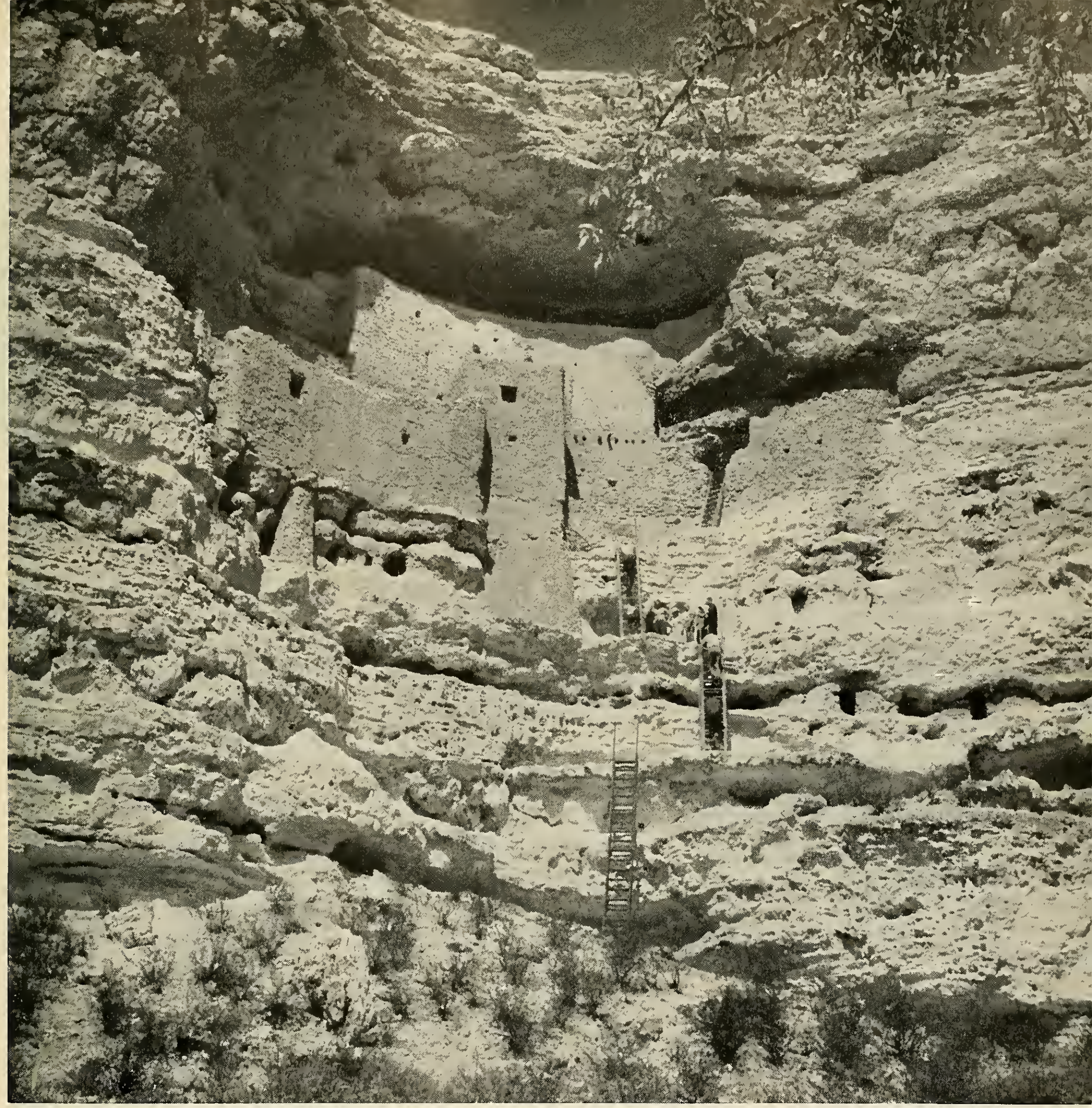
Stake No. 7 brought us to an amazed halt.

"Behind this stake," explained the guidebook, "is a large ground floor room. It is one of over 40 rooms which once made up this great six-story cliff dwelling. The building was destroyed by fire several hundred years ago . . ."

We hadn't previously realized that any tangible evidence remained of that grand structure which originally had contained twice as many rooms as the immense pink castle

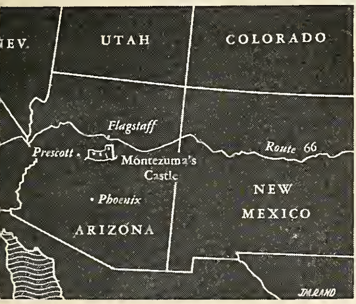
Nell Murbarger photo

◀ THE RICH BOTTOMLANDS of Beaver Creek and the Verde River were tilled by the prehistoric farmers who inhabited Montezuma's Castle



Nell Murbarger photo

▲ **Ninety per cent intact** after about 900 years, Montezuma's Castle stands as one of the Southwest's most magnificent building projects of prehistoric times



100 yards to the east. On the floor of the room, presumably as some Indian family had left them, lay a couple of primitive milling stones—a trough-shaped metate and a small mano.

Another few steps along the cliff's base took us to a cave designated by park authorities as the Charnel House, and a short distance beyond lay the cemetery.

Nothing about this primitive burying place is remotely suggestive of a modern mausoleum; yet, strangely speaking, that was its function. The limestone ledge, crossed by the trail, originally extended out to form a roof over seven graves, all of which were carefully sealed by slabs of limestone. Excavation of the seven graves produced parts of fifteen skeletons. The accepted theory is that the cliff dwellers became crowded for cemetery space and were forced to shovel out old graves to make room for brethren more recently departed. Evidently not too

National Park Service photo

▲ MONTEZUMA WELL, a natural spring. Several well-preserved cliff dwellings can be seen in the upper portion of the wall encircling the "well"

much care was given to removing the complete skeleton.

Continuing along the fascinating, sycamore-shaded foottrail, we soon found ourselves back at the point of beginning, where a ranger informed us that the first nine persons who arrived would be accommodated on the first tour.

The ladders by which one reached the castle proved to be thoroughly well made and sturdy. We had wondered how visitors could be restrained from entering the ruin unescorted. The answer lies in the second ladder, which extends over a portion of the cliff unscalable except possibly by alpinists. Strong shutter-like doors were folded over the ladder from either side, effectually covering the steps. Only after this contrivance had been unlocked by the ranger's key and the shutters laid back was it possible to proceed up the cliff. Only three persons at a time were permitted on any of the ladders.

With all our party safely up the fourth ladder, we entered the first of the castle's rooms. Coming, as we did, from the glaring sunlight, this tiny cubbyhole seemed to possess more of the attributes of a dungeon than of a castle. It was long and narrow and windowless, save for two small portholes in the front wall just above the floor line.

As our eyes became more accustomed to the semidarkness, we could see that the original wall surface was heavily coated by the smoke and grease of countless cookfires. Multiple fingerprints of the ancient builders were visible in the adobe plaster, where they had been impressed centuries ago while the material was still fresh and yielding.

From this room we passed into others, both larger and smaller. One of them was barely six feet square and so low that none of our party—not even the nine-year-old youngster—could stand wholly upright in it; yet smoke-blackened walls indicated that it had been used for dwelling purposes. All the rooms were poorly lighted, and while many southwestern cliff dwellings are provided with holes to permit the escape of smoke, these had none.

On the west coast we consider sycamore one of the less durable woods, roughly comparable to poplar or willow. How was it then, I asked, that these centuries-old beams were still sound and nearly as hard as marble? The ranger agreed that sycamore wood is quick to deteriorate in a wet, humid climate. "Here in the aridity of the desert, however," he explained, "it is almost impossible to place a time limit on its endurance."

While the ceilings of the rooms all varied in some degree, the general plan seemed to consist of one or two main beams, about a foot in diameter, laid lengthwise. Across these beams were smaller cross rafters. These, in turn, were covered with a thatch of willows or grass and finally with a layer of hard-packed mud. In this manner, the ceiling of one apartment became the floor of the one above. In some rooms, the willow withes had been fastened in position by strands of yucca fiber; and in one room, the thatching medium appears to be corn leaves.

What became of these people? No one knows. Possibly the sporadic attacks of warring tribes from the north increased in fierceness and frequency until it was no longer possible for the cliff farmers to till their fields and produce food. Or, possibly, long centuries of use brought exhaustion to the soil, as has happened since the world's beginning and still is happening where men farm with more attention to the present than to the future.

One factor that may certainly have contributed to the pueblo's abandonment (and perhaps the chief factor) was the unhealthful conditions engendered by dark, smoky rooms, serious overcrowding of population, and absence of all sanitary facilities.

Such remnants of the population as remained on the Verde in the fifteenth century are believed to have made their way north to the Hopi villages, there to be assimilated by the friendly tribe with which they had long previously established trade relations.

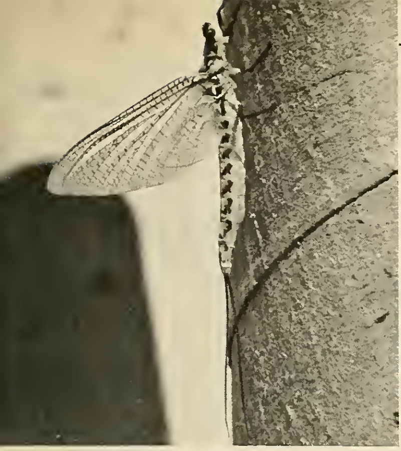
As we left the mellow old castle and started the return pilgrimage down the ladders, it came to me with some surprise that I was still completely in the dark on many of the questions about this place that had so long puzzled me. Sometimes I wonder if it isn't pretty much as the late Frank Pinkley, "Boss Ranger" of the National Park Service, once observed.

"The known history of Montezuma Castle," said Mr. Pinkley, "is especially interesting . . . because there is so little of it."

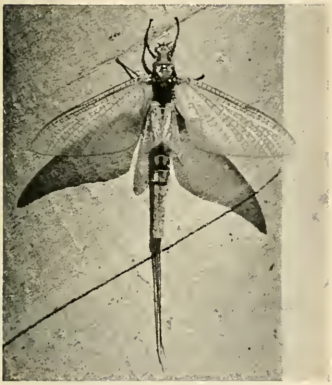
A May Fly SHEDS ITS SKIN

The only insect to molt after acquiring fully developed wings performs for the camera

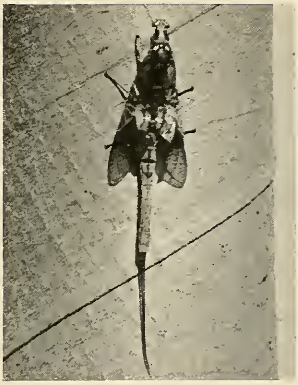
By Janice Hintz



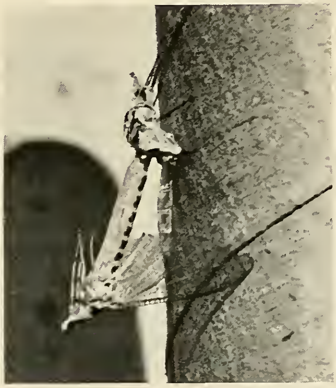
▲ Here we see the May fly in its natural position, with wings held upright. This stage is called the subimago and precedes sexual maturity



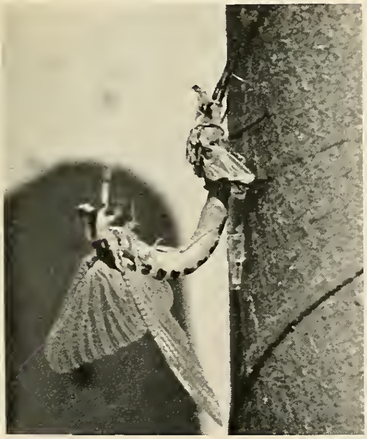
▲ First Step: Just before the May fly starts to shed its skin, it puts its wings down flat and then flits for a minute or so



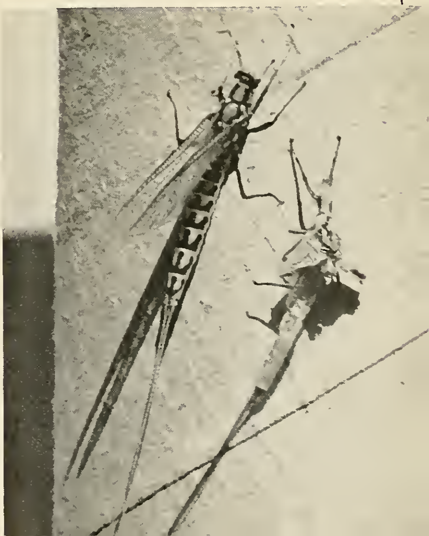
▲ Second Step: The skin between the wings splits, and the May fly pulls its thorax and head out of its old casing



▲ Third Step: After the May fly has freed its wings and body, it does a back flip. It hangs as if it were dead for a few seconds



◀ Fourth Step: Then it struggles to get upright again. It took this May fly five minutes to shed its skin



▶ All Finished! The May fly emerges from its ghostly skin, shiny and beautiful. Its wings glisten like golden cellophane. The insect waits beside its dried, crumpled skin until evening. Then it flies away into the night

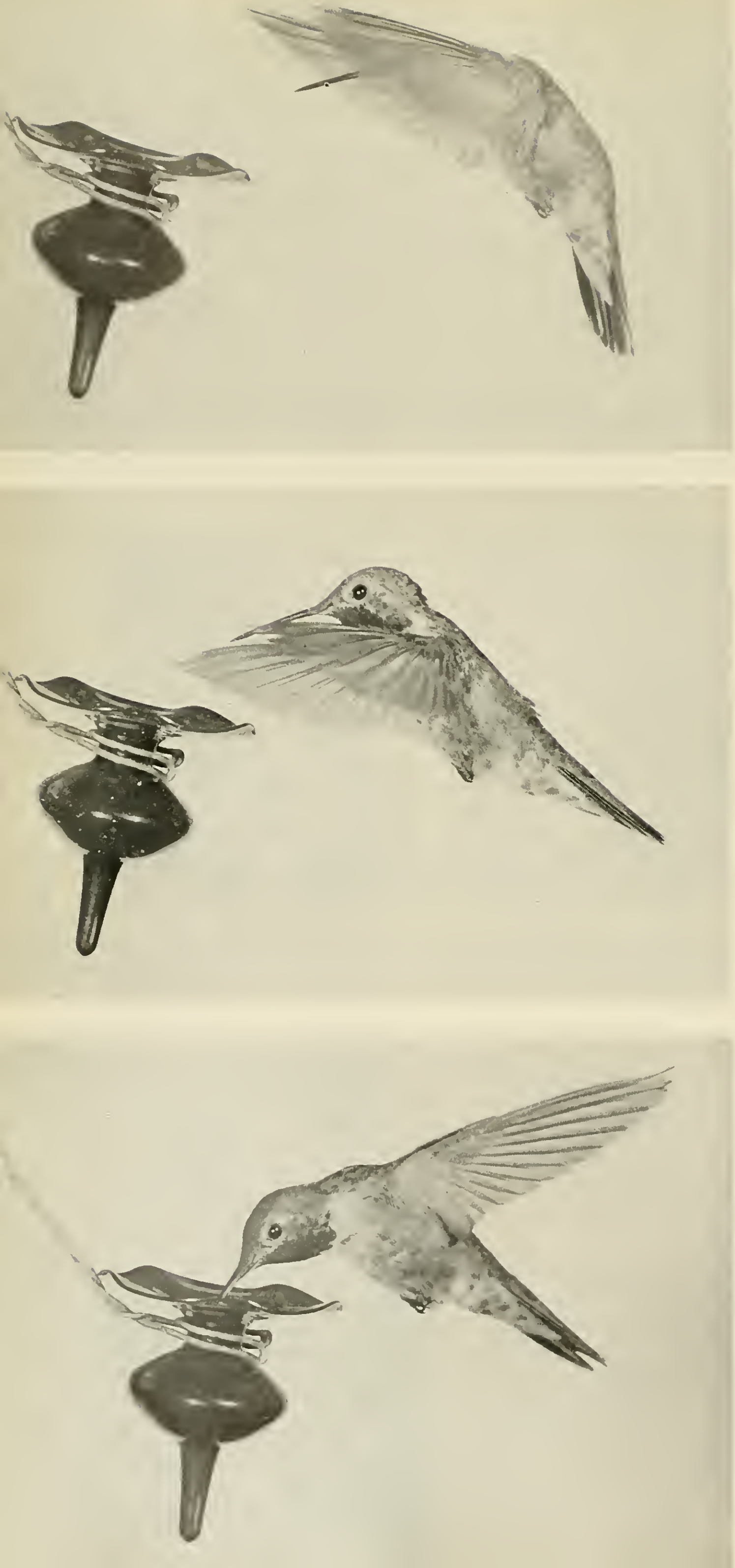
Whistlin

THE male Broad-tailed Hummingbird has the distinction of possessing a characteristic that sets him apart from all other birds within his range. All hummingbirds make a humming sound in flight. That is why they are called hummingbirds. But the Broad-tailed Hummingbird may be identified instantly by his unique trilling or whistling sound. He is nearly always heard long before he is seen.

To the observer hearing it for the first time and seeing the bird in action, this seems definitely to be of vocal origin. It has been variously described as "a shrill trilling," "a shrill screeching noise, something like that produced by a rapidly revolving circular saw when rubbed by a splinter," or "a curious, loud, metallic, rattling noise."

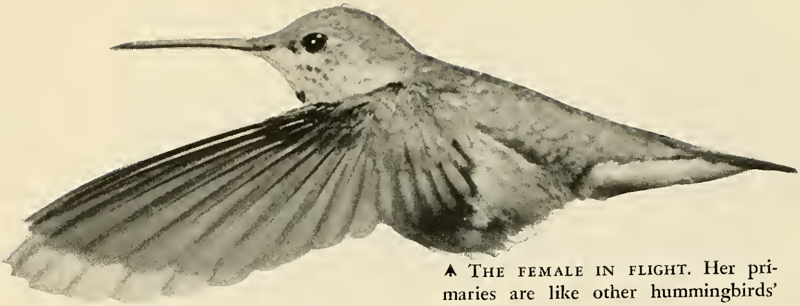
Close observation shows that the intensity of the sound is correlated with the rate of vibration of the wings. There is little or no sound when the bird hovers before a flower, the vibration rate then being about 55 beats per second. It is distinctly audible in ordinary level flight, when the beat rises to 75 or thereabouts. And it is loudest in the dive-bombing courtship display, when the rate has been estimated to be as high as 200.

The accompanying pictures are high-speed electric flash shots taken



◂ These three photographs of a male Broad-tailed Hummingbird approaching a syrup cup show the feathers that cause the whistling sound. The first two, or outermost primaries, are shaped differently at the ends, forming a slot through which the air whistles

Wings



▲ THE FEMALE IN FLIGHT. Her primaries are like other hummingbirds'

Though he may not sing a note, you will hear the Broad-tailed Hummingbird before you see him, and you need have no doubt as to who he is

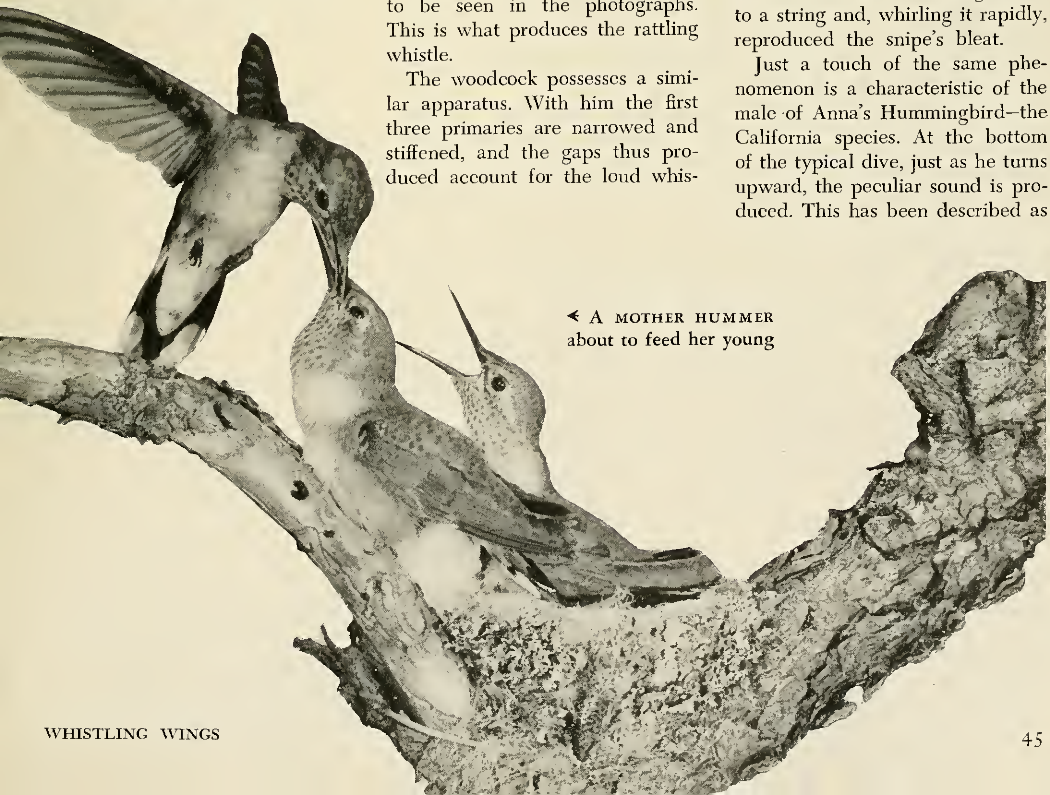
By WALKER VAN RIPER *and* ROBERT J. NIEDRACH

Denver Museum of Natural History

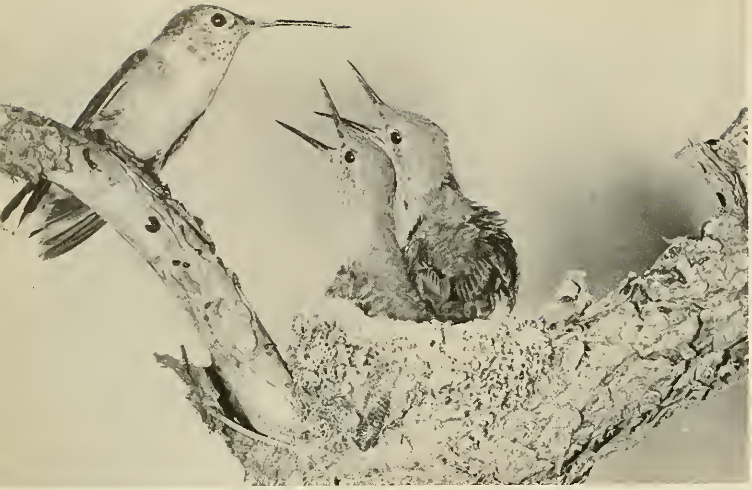
with the apparatus invented by Dr. Harold E. Edgerton of M. I. T., with exposures of about 1/10,000 of a second. They illustrate the differences between male and female wings and at the same time explain the source of the sound. The female in flight makes only the usual buzzing or humming sound of the hummingbirds. When her wing is spread, it is clear that all the primary feathers are normal in shape. In the male, however, the first two or outermost primaries are uniquely modified, being narrowed at the tips to produce the little gap to be seen in the photographs. This is what produces the rattling whistle.

The woodcock possesses a similar apparatus. With him the first three primaries are narrowed and stiffened, and the gaps thus produced account for the loud whistling accompanying the flight love song. This whistling, too, has often been mistaken for "voice." Another bird with modified feathers that produce a characteristic sound is the snipe. In the courtship flight the bird rises to a great height and then plunges earthward in a terrific nose dive, emitting a weird noise that has been likened to the bleat of a goat. That this strange noise is produced by the peculiarly formed outer tail feathers was demonstrated by a Danish naturalist many years ago. He fixed the tail feathers in a weight tied to a string and, whirling it rapidly, reproduced the snipe's bleat.

Just a touch of the same phenomenon is a characteristic of the male of Anna's Hummingbird—the California species. At the bottom of the typical dive, just as he turns upward, the peculiar sound is produced. This has been described as



◄ A MOTHER HUMMER about to feed her young



▲ The "normal" shape of her wing feathers is seen from this photograph of the female hummingbird feeding her children on the wing. These pictures were taken at about 1/10,000 of a second

a *klip, plip,* or *speek,* or as resembling the "bark of the California ground squirrel." It has been shown that this is due to a narrowing and bending of the outermost tail feathers.

The Duke of Argyle, in his *Reign of Law*, demonstrated (by a logical, not an observational, process) that "no bird can ever fly backwards." The hummingbird, he said, might appear to do so when leaving a tubular flower, but in reality the movement is a fall rather than a flight. Many observers, however, have contradicted this statement, and there is not the slightest doubt that hummers can fly in any direction—up, down, sideways, forward, and backward. The bird shown in the accompanying photographs feeding her babies on the wing actually flew backward and a little upward to attain this position. She ordinarily lit beside the nest and began feeding the young, but if she were frightened a little by the camera or the photographer, she would take wing and continue the feeding operation from the position shown. Of the many hummers watched by the writers, this is the only one ever seen to do this trick.

LETTERS

Continued from page 2

nated "pommel" for the firm purchase of one's finger, and also (apparently because the blowhole was thereby plugged) to make certain that the air-breathing animal would not submerge while being ridden.

W. H. Hodge.

Amherst, Mass.

Blind Fish

Sirs:

Robert R. Miller, in his article "Desert Fishes" appearing in the December issue of Natural History Magazine, doubts the discovery of "authentic blind fish in the fresh waters of western North America," and asks for reliable information to the contrary.

Dr. Miller has evidently overlooked *Anoptichthys jordani*, a blind characin. This fish was discovered in a cave in San Luís Potosí, Mexico, in 1936. Professor Carl L. Hubbs identified it as a new species, probably descended from *Astyanax mexicanus.* This was reported by the New York Zoological Society and the New York Academy of Sciences.

Jordani is about three inches long, is a pale translucent pink, and has rudimentary buds in place of eyes.

Arthur M. Blum.

Brooklyn, N. Y.

Dr. Robert R. Miller of the University of Michigan's Museum of Zoology comments as follows:

I much appreciate the interest shown by Mr. Blum. The expression "western North America," as I use it, includes only the Pacific and Interior (Great Basin) drainages of North America. I am familiar with that remarkable blind characin, *Anoptichthys jordani* and with two closely related species, *A. antrobius* and *A. hubbsi,* described recently from limestone caves in the same region. This area lies inland from Tampico, in San Luís Potosí and Tamaulipas, in the drainage basin of the Río Pánuco, which is an Atlantic tributary. It might also be pointed out that there are two blind catfishes known from the vicinity of San Antonio, Texas, in almost the same longitude as the Mexican blind fish. Again, however, the subterranean waters drain toward the Atlantic.

Let us continue to hope that someone will find blind fish from the Pacific drainage of North America.

A Woodsy Odor

Sirs:

My secretary, Mrs. Helene Gonzales, who happens to be a member of your Museum, called my attention to the front-page article in the *Herald Tribune* reporting the unique idea of scenting Natural History Magazine with a pine fragrance.

Permit me to compliment you; I think the idea is a splendid one. . . . As a hobby, I am immensely interested in the educational phases of our olfactory sense. I find that children are easily stimulated by novel and unusual odors within the aesthetic field, and their comments and reactions are very revealing from a psychological point of view.

For this December you appropriately selected Pine, which is so pleasantly reminiscent of our Christmas Festival. Would it not be possible to scent subsequent copies with specific and exotic plant derivatives and at the same time associate the scent with an interesting story about the particular plant? . . .

Alfred H. Moeller.

New York, N. Y.

Sirs:

As a friend and also as a subscriber to Natural History Magazine, I will look forward to receiving my pine-scented copy, reminiscent of the fragrance of the pine woods. . . .

M. Fred Cartoun.

New York, N. Y.

Sirs:

. . . Regarding the odor impregnation of Natural History, of which I happen to be a subscriber, it may be of interest to you that the process of perfuming magazines originated with me way back in 1937 . . . in *New Ideas.* The print order was 75,000 copies, and the odor was quite strong after one year. We decided against pine and a number of others, using instead a sort of fruity odor, which we knew would last longer. . . .

Hugo Gernsback.

New York, N. Y.

Sirs:

I have read with great interest of the printing of Natural History with pine-scented ink. I am wondering whether it would be possible for us to try a similar venture here at the Eaglebrook School. We have a most unusual press and printing department and are located on a mountainside surrounded by pines. The Eaglebrook School Press is run exclusively for the students. . . . Would it be possible to obtain some of the ink through your printers? No more than a pound would be necessary for our paper at Carnival time next February. . . . I am sure our students would be greatly pleased and their interest in the graphic arts stimulated.

Richard Dyer,
Director.

The Eaglebrook Press,
Old Deerfield, Mass.

(A pound of the pine-scented ink is on its way to the Eaglebrook printers, with the compliments of Natural History Magazine.—Ed.)

Sirs:

Being greatly interested in your initiative in printing an edition of Natural History with scented ink, I write to ask whether it would be possible for you to send me a sample of the Magazine. . . .

Jean Alexandre.

Algiers, Algeria

Dear Meester:

Please send mine next month widout the synthetic pine from de Maine vuds!! De "brand" from de cactus in de pine vuds—so pretty on de cover—is especially irritating to my nasal membranes! I sneeze! I headache! I find most perfumes quite irritating to my skin. . . . So please . . . send my next copy widout. Thanks.

Mrs. Sigmund Epstein.

P.S. I apologize, too, to all those who enjoy and like perfume.
New York, N. Y.

From the Press

"The staid American Museum of Natural History has beat the whole magazine publishing field at its own game. . . ." (New York *World Telegram.*)

"This week subscribers unwrapping their December copies of Natural History were pleasantly surprised. . . ." (*Newsweek.*)

It . . . deserves, we think, the attention and the delighted anticipation of the literate world." (New York *Herald Tribune.*)

Fish-divers through the mist: Gannets of Bonaventure Island in the Gulf of . Lawrence, brought to us by the distinguished bird photographer, Allan D. ruickshank

◂ **Sir Peter and Lady Buck**, with others of the party, in the place of honor during speeches of welcome. Each meetinghouse is identical in plan, but they vary in design

THE MAORIS WERE OUR HOSTS

Continued from page 14

food as we could eat. At all the feasts that we attended, the food was delicious and abundant. More than that, the joy of hospitality written on each host's face at every pa was beyond anything of the sort I have ever seen. Watching those generous men and women, one was ready to find excuse for the fact that 100 years ago in Maoriland people were sometimes eaten instead of being fed. Was it so much worse to eat an enemy than to torture him with living death as the whites have done: the rack, the stake, the third degree, or the agony of the last war?

In nearly all the village feasts, the food was cooked outdoors in pits—steamed with hot stones—chicken and every kind of meat and fish, including the Maori dish of eels. Once we were served the royal dish of pigeon. It made me sad, conservationist that I am, because the number of wild pigeons is very much depleted. There were vegetables and salads, and brilliant-hued desserts. Everything was good.

At Te Puea's pa, in the evening, an ordinary dance was attended by both whites and Maoris. Without native clothes and rhythms and bare feet, the Maori boys and girls were not a whit more graceful than if they never took their part in the beauty of their native dances.

The floor was cleared shortly after our arrival. The girls took off their shoes and changed their party dresses to bend to unseen paddles in the lovely swaying of the canoe poi dance, their chanting rising and falling to the poi balls, which sounded like paddles in the water. It was the dance of the Tanui Canoe, one of the Fleet whose several canoes are to Maoris what our "Mayflower" is to us. As the dance progressed, dancers bending, poi balls flying, the leader called for quicker, quicker motion: "I see New Zealand! All the power in your human bodies give to these paddles! Land is there!" Every gesture had its meaning in the story. One dancer even depicted a bird that flew past the canoe.

After leaving Ngaruawahia we drove to Rotorua, in the thermal district. From the hill above the lake, we could see the wooded island to which Hinemoa swam to join her lover. We drove through the town past the Maori village of Whakerewarewa, where the people cook over thermal heat and wash in thermal water cooled enough to touch. Here geysers shoot, mudholes boil, and the ground steams. The heat came through my walking shoes, but the Maoris walked there barefoot. Sometimes a child has fallen into the boiling pool from which no person could be saved alive.

We drove to Horahora. Outside the gate a sacred stone is a guide to all the actions of the villagers: the Hinengawari Stone. Out of deference to our waiting hosts, we laid green leaves upon it.

This was a simple pa. The meetinghouse served also as a school. On the wall I saw a childishly-drawn picture of Santa Claus dressed in his furs but in the summer setting of December way "down under."

We visited every kind of pa all over the East Coast, where sandy, golden beaches curve between great headlands. Sometimes the children danced. Once a group of youngsters aped their elders, with one small rascal in a flax skirt to his ankles sticking out his tongue, grimacing, rolling up his eyes in perfect mimicry of older warriors. We saw action dances, boasting dances, furious war hakas, games. Often there were jesting dances, with fun in every movement. These made me wonder if some of the rock pictures found by scientists were done in humor, too. There is one in the Christchurch Museum of a female figure with exaggerated arm and fingers, a real "come hither" picture.

"Dr. Buck," I asked, "do you think that some of those old paintings found in caves are funny? Has any anthropologist ever written on their humor?"

"No," he said "but you can."

I can't imagine Maoris not having a good time, whether they were drawing on the rocks 600 years ago or dancing in their villages today. A child, a wonderful old grandmother with tattooed lips and chin, those so fat they ought to waddle—all enjoy their fun.

Except in sorrow. I saw one boy with arms around a weeping older woman. I have a Maori friend who cannot find a comfort left in life since she lost two children. Everywhere I went among them there was kindness for my deafness such as sensitive people feel.

The study of alien peoples should be far more a part of education than it is. Children would lose the strangeness when learning the similarities and differences of other races. Anthropologists today, in their new and human approach, have already created friendship, co-operation, and interest in their scientific research with the very people they study. It is one more way to bring the world together.

ebruary NATURAL HISTORY *195*

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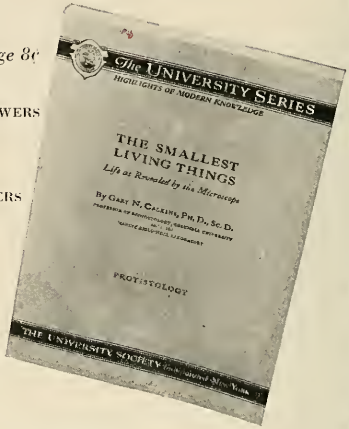

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LETTERS

Siamese Trees

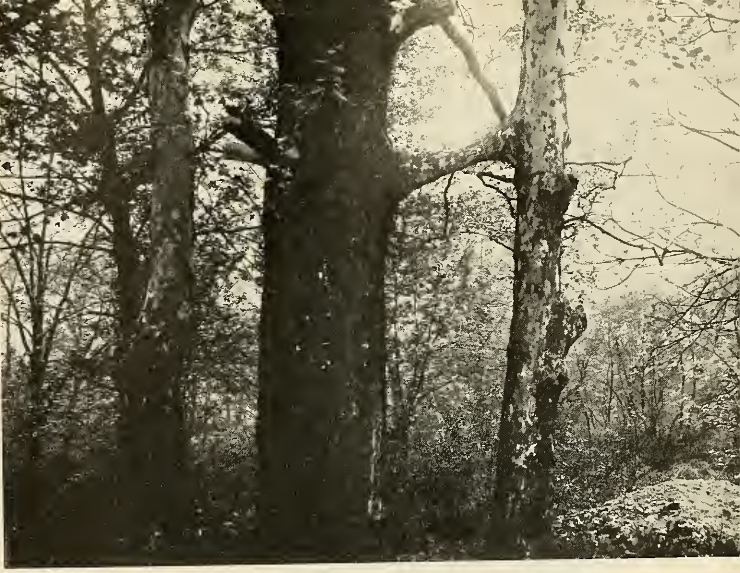
SIRS:

Readers of NATURAL HISTORY Magazine might be interested in these two trees, which have become joined together. They have been thriving for at least 20 years. This curious sight can be seen immediately south of Rutherford, New Jersey. The trees are on the west side of the River Road along the east bank of the Passaic River, a short distance north of New Jersey Route S3.

The link between the two trees is well over head-high, and you will note that some of the limbs have been trimmed so that the trees can show their strange connection to passers-by. Both are sycamores. The grafting of the limb of one tree to the trunk of the other must have taken place naturally.

C. J. BATES.

Englewood, N. J.



Longer Evenings or Shorter Days

SIRS:

If December 21 or 22 is the shortest day in the year, can you tell me why the sun begins to set later each night a week or so *before* that date? This question came up when some of us were discussing the proper date for the end of the year.

The Nautical Almanac shows that the sun reached its southernmost point on December 21 and started north on December 22. But the sunset was at its earliest from December 2 to December 14 in 40° N. lat. So the evenings were getting longer before we reached the shortest day in the year. At the same time, the tables show that we do not get the latest sunrise until after the shortest day—from December 30 to January 12. Could you please explain this?

HERBERT R. SPENCER

Erie, Pa.

Most persons never notice, as Mr Spencer has, that the shortest day in the year does not *seem* like the shortest day in the year. But the sunlight we have begun to gain in the afternoons prior to December 21 is being lost in the mornings, as his letter implies. This is due to the fact that clocks and watches do not agree with the sun. When your watch says it is noon, the sun may be about a quarter of an hour on either side of its highest position. You can easily prove this by comparing your watch with a sun dial. At one extreme, on November 6, the sun dial will tell you it is noon when your watch reads 16 minutes 19 seconds before noon. At the other, on February 11, the sun dial will register noon when your watch says it is 14 minutes 25 seconds past noon. This difference between clock time and sun time is called the *equation of time.* The eight-shaped figure on some globes, which is known as an analemma, tells the amount of this difference at any time of year.

The reason for this varying discrepancy is that the earth moves at a varying speed in its elliptical orbit around the sun. It happens that around the shortest day in the year, the sun and your watch are quite close together. But during the preceding weeks, the sun has been ahead of your watch and is "slowing down" to meet it. This gives the impression that the afternoons are getting longer, instead of shorter. Of course, if you time the *rising* of the sun each day, you will see that the mornings are getting shorter. In fact, they are losing sunlight faster than the afternoons are gaining it.

After the shortest day in the year, the sun continues to fall behind your watch, and because the day actually *is* getting longer, it appears to be lengthening more rapidly than is the case.

In the tropics, where the length of day varies little, the equation of time really "takes over." Hence on the equator the sun begins to set later in the early part of November!—ED.

North America's Most Violent Quake

SIRS:

I note in your September issue of NATURAL HISTORY some very interesting correspondence regarding earthquakes.

While making surveys in 1927 for a natural gas pipeline from Monroe, La., to St. Louis, our line passed through the southeastern part of Missouri near New Madrid. My attention was called to the so-called earthquake or subsidence that occurred in that section in 1813.

It was reported that the surface settled from ten to twenty feet and that the Mississippi River flowed both ways into an underground cavity. Reelfoot Lake in Tennessee was reported as formed at that time. Further investigation disclosed a U. S. Government report on the subject, I think by the U. S. Geological Survey, which gave many details of the "subsidence." The report quoted data furnished by an English botanist who was investigating the flora of that region and who was present at the time of the "quake."

I conferred at the time with a Jesuit priest, a seismologist at the University of St. Louis, who was in charge of the University seismograph. He spent several hours with me, gave me a five-page report on the subject, and furnished me with a map on which the area affected was outlined.

His seismograph had indicated recent vibrations. He stated that brick chimneys in Paragould and Jonesboro, Arkansas, were still being damaged. His advice was, "Stay out of that country or build a rubber pipeline." The good man was pleased to have someone consult with him on a practical question such as the location of a natural gas pipeline.

This fall we were on a trip up the Mississippi River on the Greenline Steamer "Delta Queen." As we neared New Madrid, we were furnished a bulletin giving the following information regarding the "quake":

"The steamer 'New Orleans,' built by Robert Fulton and sponsored by Nicholas Roosevelt of New York, a great-uncle of a later president, was the first steamboat to make the trip down the Ohio and Mississippi Rivers to New Orleans. Incidentally, she never made the return trip due to lack of power and excessive draft.

"Nearly sixty miles down river from Cairo, Captain Roosevelt noticed that his boat was going upstream instead of down, although his engines were set to propel her toward New Orleans.

"A forced landing was made but no reason for the strange reversal of the current could be learned. The river flowed upstream for three days and nights.

"When the boat stopped at New Madrid, it was learned that a great earthquake, of non-volcanic origin, had occurred near New Madrid, and the upstream flow of the river was due to its filling a great underground cavity. Today this crevasse is known as Reelfoot Lake."

I would greatly appreciate hearing from Mr. L. Don Leet, Seismologist at the Harvard University Seismograph Station, as he probably has more detailed information on the subject.

Frank H. Shaw

Lancaster, Pa.

The following comments are offered by L. Don Leet, Seismologist in Charge of the Harvard University Seismograph Station, at Harvard, Massachusetts:

The series of earthquakes to which Mr. Shaw is referring were probably the most violent of any known in North America during the period covered by our historic records.

These so-called New Madrid earthquakes were in 1811 and 1812. The first large one occurred at about 2 A.M., December 16, 1811. The second, of similar magnitude, was on January 23, 1812, and the third on February 7, 1812. For at least a year there were smaller shocks of varying intensity every few days. The region has been subjected to intermittent activity since that time and is regarded as one of the relatively few in the United States in which there is probability of major destructive earthquakes.

The geological environment of these shocks accounts for many of the spectacular surface changes and may be connected with the forces that produced the quake. The region is at the tip of what is known geologically as the Mississippi Embayment, and topographically it is the St. Francis Basin. The Basin is filled with thick river flood-plain deposits of unconsolidated alluvium and is bordered on the east by deposits of loess—very fine-grained dust deposits accumulated by a combination of wind and river action. The heavy shaking of a major earthquake causes landslides, slumps, and extensive general movements in such materials.

Some land areas sank as much as 15 feet, though amounts of 5 to 8 feet were more common. Some of these areas then flooded and became lakes, with the remains of trees dotting their bottoms. Reelfoot and St. Francis are two such lakes. One area, known as the Tiptonville Dome, 15 miles long by 6 to 8 miles wide, was raised 10 to 15 feet above the level of the highest floods.

Elevation here and settlement there, combined with extensive landslides along the banks, resulted in very turbulent conditions in the Mississippi. Strong upstream waves (similar to miniature tidal waves) and associated currents gave the effect of the river flowing upstream. Such conditions may have been repeatedly observed, but I question the report that the river "flowed upstream for three days and nights" to fill Reelfoot Lake. There was a large element of hysteria and superstition intermingled with on-the-spot reports of those days. These included mysterious flashes of fire (lightning from thunderstorms in the vicinity) and sulphurous fumes (marsh gases released by the disturbed swamp areas). The effects were widespread and spectacular but not mysterious.

The largest shock produced vibrations in the ground strong enough to be felt in such distant points as Boston, 1100 miles away. The quake was felt from Canada to New Orleans and from the headwaters of the Missouri to the Atlantic—a total area of about one million square miles.

Hands Across the Sea

SIRS:

Some of the members of our Dutch Youth Association for Nature Study have wanted to start correspondence with young people in various parts of the world. This month we received our first request for an address in the United States. The Dutch Natural History Society suggested that we write to the American Museum of Natural History. We have heard of your wonderful magazine, NATURAL HISTORY. Our members are 12 to 23 years old, corresponding members 16 to 23. We would be very grateful if you would send us the addresses of any young people who might like to correspond with our members.

Hans Andreae

Nederlandse Jeugdbond
voor Natuurstudie
Lammenschansweg 47
Leiden, Holland

Any readers of NATURAL HISTORY between the ages of 16 and 23 who wish to establish contact with Hollanders having kindred interests are encouraged to write to Mr. Hans Andreae at the address given above. —ED.

Palms

SIRS:

As a long-time member of the American Museum, and for several years a member of the Fairchild Tropical Garden, I have been hoping to see something about the Garden in NATURAL HISTORY. There was such a reference in Walter Henricks Hodge's article on Palms in your November issue, but it implied that this is Dr. David Fairchild's own garden rather than one named in his honor.

For many years, Dr. Fairchild had worked toward the establishment in subtropical Florida of a place for the collection and study of tropical trees and shrubs. The organization was incorporated under the laws of Florida and has 850 members. The purchase of the 83 acres of land and the erection of most of the buildings was financed principally by Col. and Mrs. Robert H. Montgomery, whose place a mile south of the garden contains some 400 species of palms—the largest collection in the United States.

I would call special attention also to a feature of Fairchild Garden not mentioned in the article—the 25 acres known as Montgomery Palmetum. More than 300 varieties of palms can be seen there, and the number is being increased every year.

A final word as to the total number of palm species, which Prof. Hodge estimates at nearly 3000. Dr. Liberty Hyde Bailey, addressing a group at the Fairchild Tropical Garden on January 11, 1946, said he had seen estimates ranging from several hundred to 11,000 and added: "No one can say just how many species there are, but I personally am familiar with more than 5000. And they are not mutations of the same or similar palms, but differ from one another as a robin differs from a bluebird."

Leonard Ormerod

Miami, Fla.

Does the Cat Come Home?

SIRS:

In the November 4, 1949, issue of the *Herald Tribune*, the following story appears:

"Hayti, Mo.—Yellow Jack, a tomcat, was back with the Clemons children today after a 600-mile, four-month walk from Michigan. Part Persian and the rest just plain alley cat, Yellow Jack originally lived in Benton Harbor, Michigan. Three years ago the cat was brought to Hayti and took a liking to the five Clemons children. His owner took him back last July. He stayed one day in Benton Harbor, Michigan, then disappeared, presumably walking around lower Lake Michigan and down the length of Illinois to the Clemons home in Missouri, arriving on November 3."

Can this story possibly be true?

Amy G. Shuey.

Jackson Heights, N. Y.

The following comments are offered by Dr. Frank A. Beach, Professor of Psychology, Yale University:

If a cat can walk 600 miles, then the story might "possibly be true." By this I merely mean to imply that Yellow Jack could, conceivably, start in Benton Harbor, Michigan, and eventually arrive in Hayti, Missouri, simply as a matter of chance. After all, thousands of cats must be lost or deserted each year. It is not too much to expect that a fraction of one per cent of this total will accidentally take a course that brings them home.

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NATURAL HISTORY

The Magazine of the American Museum of Natural History

F. TRUBEE DAVISON, President
WAYNE M. FAUNCE, Vice-Director
In charge of Publications
ALBERT E. PARR, Director

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FEBRUARY, 1950

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You will find NATURAL HISTORY Magazine indexed in *Readers' Guide to Periodical Literature* in your library

THE COVER THIS MONTH

The largely epiphytic ("tree-sitting") family of the Bromeliaceae is one of the most characteristic and exotic groups of plants indigenous to tropical and subtropical America. Strangely, a single species hails from Africa. "Spanish Moss," (*Tillandsia usneoides*) and the economically important Pineapple are the best known members of this interesting family. Visitors to the Caribbean countries may become acquainted with the plant whose portrait appears on the cover — Pinguin (*Bromelia Pinguin*). Pinguin, or *Piñuela,* as it is sometimes called, is pineapple-like in general appearance and in its terrestrial habit. Its thick, mealy-white spike bears white to pale rose flowers. These mature into yellow, plum-sized fruits with a pleasant though slightly acid taste. The succulent leaves, often six feet in length, possess fine, strong fibers, which are often utilized by aborigines in the tropics for a number of domestic purposes. Probably the most important use of Pinguin today, throughout its range, is as a dooryard plant to form living fences. The sharp, stout teeth that margin the leaves are formidable obstacles to man and animal.

W. H. HODGE

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YOUR NEW BOOKS

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Anthropology • America Through British Eyes

AMERICAN INDIAN SCULPTURE

---------- by Paul S. Wingert

J. J. Augustin, $7.50
144 pp., 7 figs., 76 plates

ALL too frequently are we presented with a discussion of primitive art that combines sound art criticism with anthropological sophistication. Mr. Wingert is an art historian with strong anthropological leanings, and his present book is an important contribution both to fine arts and to ethnology.

The general title is, unfortunately, misleading, since this handsome volume is actually a highly specialized study, dealing almost exclusively with the wood sculpture of the Salish tribes of Washington and southern British Columbia. Although these fine carvings have heretofore attracted little attention as compared with the more elaborate productions of the tribes farther north, Salish art is a mature and developed tradition, representing, perhaps, an earlier basic style out of which Northwest Coast art grew.

Salish wood sculpture consists of carvings in the round and in relief, most of which were of a religious nature and were associated with shamanism. Mr. Wingert wisely discusses these objects against the broader background of Salish culture generally. The body of the book is concerned with a classification of the carvings and with the delineation of tribal and regional styles. The author recognizes five subareas of Salish art, within which he postulates ten "style centers" and seven "major traditions" (based on style and technique). In a cautious historical analysis, he favors an inland, or upriver, origin of Salish sculpture, perhaps in the region occupied by the Duwamish tribe of central Puget Sound.

Although the book is a scholarly study intended primarily for the specialist, it should make fascinating reading for anyone interested in American Indian art. The excellent photographs, many hitherto unpublished, provide a mine of material for the art student and designer. The rigid stylization and stark simplicity of Salish sculpture echoes recent trends in modern art, and the best pieces compare favorably with the now well-known productions of West Africa and Oceania.

HARRY TSCHOPIK, JR.

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A NORTH CAROLINA NATURALIST—H. H. BRIMLEY

Selections from His Writings

----- edited by Eugene P. Odum

Univ. of North Carolina Press, $3.50
205 pp., 44 illusts.

THIS book is prepared as a memorial tribute to H. H. Brimley, native of England, who served as a respected employee of his adopted State from 1884 to 1946. In preparing this volume, the approach was to use selected papers from his writings on history and natural history, which were in the files of the North Carolina State Museum. They were prepared by Mr. Brimley in the course of his work to build a Natural History Museum that would attract visitors and teach the fundamentals of the natural sciences.

The selected papers were organized by the editor into six groups, based on chronology and subject matter. To this the editor adds a biographical summary that carries H. H. Brimley in his vocation from youthful naturalist to retirement as Museum Director. The editor has a note introducing each of the groups of writings for the purpose of biographical continuity.

These papers range from commercial egg-collecting in 1880, commercial wildfowling on Currituck Sound, Cape Hatteras, in 1906, the early State Fairs, hunting and fishing episodes, early waste and later conservation of wildlife resources, a native whale fishery, sharks and their behavior, the story of mammoth and mastodon remnants, interesting native birds, and the development of the State Museum until 1928.

Altogether, this is a commendable effort to record the works of one man during a long career. Many admirable facets of a lovable character are not included. Friends will like this book for personal reasons. Students will appreciate a new view of North Carolina during the first half of this century.

HARRY T. DAVIS

ABBE DAVID'S DIARY

----- translated by Helen M. Fox

Harvard Univ. Press, $5.00
302 pp., 16 illusts.

THE Catholic missionary Armand David was one of the great plant and animal explorers of the nineteenth century, and the records of his travels are scientific documents of great value. He was not only a dauntless explorer but a good naturalist who brought back large collections from remote regions of China. To the American layman, he is best identified as the man who "discovered" the giant panda, a remarkable bearlike creature. The extensive diaries of David's three journeys were published in France during the eighteen-sixties and seventies. These journeys lasted four and a half years and took him over much of northern, central, and eastern China.

The present attractively printed and illustrated volume is an abridged translation of the first two journeys; the diary of the third one was not included because the translator considered it less interesting. I disagree on this point and urge completion of a task so well begun.

David wrote with unusual simplicity and clarity, and his writing has not suffered in the expert hands of Mrs. Fox, who, as a matter of fact, demonstrates her own ability in a brief biography of the missionary. The diaries include many interesting observations on plants and birds, and the mammals and other animals are not neglected. David was a good general observer and recorded much of interest about China; unfortunately, lacking the ability to view things celestial from a broad point of view, he made many unduly harsh statements about the Chinese. To his credit, he was dauntless in the face of sickness and other severe discomforts.

Names of Chinese localities and technical names of animals and plants have not been handled well; only some of the former have been changed to the form familiar in English, and only some of the latter have been brought up to date. It would have been better to change all of the place names and leave the animal and plant names just as David used them. A list of

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by Alfred M. Bailey

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by Charles Allmon

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by Wanda Mills

STEPPING STONES IN THE PACIFIC *February 25*
by Alfred M. Bailey

SOMETHING'S ALWAYS HAPPENING IN THE ZOO!
by William Bridges *March 11*

SWISS JOURNEY *March 25*
by Karl Robinson

WILDLIFE IN ACTION *April 8*
by Dr. Olin Sewall Pettingill, Jr.

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recent equivalents could have been combined with an index, and a map certainly should have been included.

Clifford H. Pope

THE COAST OF NORTHEAST GREENLAND

----------- by Louise A. Boyd

American Geographical Society, $6.00
356 pp., 16 maps, 179 figs., plus illustrative material

IN 1937 and 1938, Louise Boyd organized and directed expeditions so that she might continue her exploration of East Greenland. Profiting by her earlier experiences, these were planned with the same objectives in mind. They gave Miss Boyd and the scientists accompanying her the opportunity to explore the coastal zone from King Oscar Fiord, about 72 degrees N., up to Isle de France, 78 degrees N. The report of this work was well along in its preparation when the war broke out. Because a wealth of information about this area was of extreme strategical importance, all the photographs of this and Miss Boyd's earlier expeditions were turned over to our Government and held as restricted information until after the end of the war. After the restrictions were lifted, the reports were finally completed and presented as a special publication of the American Geographical Society.

The sea ice coming down from the Arctic Basin presses in along this part of the coast so as to prevent access by sea throughout most of the year, occasionally throughout the entire year. Because of sudden shiftings in the position of the ice, an expedition in this area must be able to change position and perhaps objectives very rapidly. The expedition in 1938 had a much more favorable season than that of the previous year. An important part of the report has been contributed by Richard Foster Flint, who was the geomorphologist in 1937. He described, and in some cases surveyed, several of the more important glaciers of the area. The results are similar to those in other parts of Greenland. Most important is the fact that the ice mass is in a state of deglaciation at present. The difficulty in interpreting some of the recently formed features should serve as a warning to those investigating Pleistocene problems in other areas. Similar studies were continued in 1938 by Bronner. In his report, more attention is given to the petrology of the area, particularly the metamorphic and igneous rocks. An outline on page 217 is the only attempt to present the geologic history.

The reports on the ecology, botany, and hydrography, including current and tide observations, contribute greatly to our knowledge of the region.

The outstanding feature of the work as a whole is its wealth of illustrations. Miss Boyd has described a technique whereby topographic maps are made from the photographs. Photography seems to be Miss Boyd's first and now her primary interest. Because of her ability, the photographs, both from a scientific and artistic point of view, make the most important contribution to the final report. Many readers of varied interests must commend the scientists and editors for presenting such a readable and informative report.

Ralph L. Belknap

THE STORY OF MAPS

----------- by Lloyd A. Brown

Little, Brown and Co., $7.50
397 pp., 84 illusts.

BECAUSE of well-fulfilled responsibilities concerned with maps and cartography at the University of Michigan, the Peabody Institute in Baltimore, and the Johns Hopkins University, Dr. Brown was the man to undertake this work of eminently readable scholarship. He calls it a co-operative venture, but the molding of complex data into simple and beautiful form is his own high accomplishment. This is no book to read in tired moments but rather, for the sake of its thread and charm, in a period of sustained and alert leisure.

The story begins with the daybreak of history, when the earth was taking shape to inquiring man. His early concern was with what he regarded as the habitable world, but speculation soon outran that, and the growth of knowledge became, so to speak, a reflection from the stars. In other words, sound theories of geography progressed along with comprehension of solar and other cosmic phenomena. Accounts of important early contributors, in a chapter entitled "The World of Claudius Ptolemy," have remarkable freshness and clarity, even though the author deals here with subjects and personalities already dimly familiar. Ptolemy (second century) well stated a famous scientific principle, usually credited to William of Occam (fourteenth century), namely, that the best explanation of any kind of phenomenon is the simplest possible hypothesis that does not conflict with the observed facts.

The author's treatment proceeds with chapters on the Middle Ages, the task of haven-finding, the trade in maps and charts that followed the invention of printing, the problems of latitude and then of longitude. The art of determining the last-named component of a geographic fix marked one of the greatest steps in the history of exploration and mapping. It depended upon the introduction of two pieces of apparatus—a telescope and a reliable timekeeper – and scientific cartography may be said to have been born in France during the reign of Louis XIV. Cash prizes of the eighteenth century for means of more accurate determination of longitude at sea (within half a degree or 30 nautical miles) were in amounts up to $100,000 or more. They outdid the bounty of modern radio advertising!

The two last chapters of this book deal respectively with the survey of a country and of the world. They cover mainly the last century and are replete with surprise. As recently as World War II, it was discovered that the earth had scarcely been mapped at all in relation to strategic needs, and that "antiquated" charts, long relegated to library files, were worthy of the utmost respect. A forecast of these circumstances appears in the Introduction to this book, wherein Dr. Brown indicates the ephemeral existence, deliberate concealment or destruction, and high frequency of loss of important maps through the ages.

The book is illuminatingly and excitingly illustrated and superbly documented. It is the kind of dateless source that one must turn to again and again.

R. C. M.

AMERICA THROUGH BRITISH EYES

---------- compiled and edited by Allan Nevins

Oxford University Press, $6.00
530 pp.

I DON'T think it need be emphasized that most people, as well as most nations, have a natural curiosity to know what others think of them. There is, however, a social restraint that tempers the fully candid expression of the way our friends and acquaintances feel about us as individuals which is frequently absent in the impressions that travelers publish about a country. As nations more readily than as individuals, we can enjoy the "giftie . . . to see oursel's as others see us."

We Americans certainly can hardly feel slighted in this beneficence, as Mr. Nevins' book amply demonstrates. The pleasure of contemplating ourselves through the eyes of our British visitors from the beginning

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of the Republic to 1946 is indeed a fascinating one. If we shrink at having our warts, pimples, and deformities described in all their horrid detail, we can expand with the encomiums heaped upon us. Irritation at the misjudgment of our guests can be balanced by the blush from undeserved praise. Then there is always the solid satisfaction of recognition in the just and penetrating analysis.

Mr. Nevins' anthology is a remarkably catholic one, drawing from the well known like Dickens, the Trollopes, Bryce, and Wells and from the forgotten writers who, despite their literary obscurity, often made shrewd or amusing observations. He has assembled his excerpts to cover a vast variety of topics, from pigs in the streets of New York to the cultural manifestations of the nation, from slavery to prohibition, from social customs and manners to political institutions. We catch glimpses of our great; we travel across the country in coaches, river boats, and Pullman; we stop at log cabins, country inns, and de luxe city hotels; we are amazed at our women and appalled at our children; we see our countrymen soberly and industriously at work, full of kindness and good deeds, and avid for literature, and then, with a flick of the page, find them sprawling, lazy, lawless, moving only to spit tobacco juice, and dead to all culture. The choice of excerpts is designed not to shield our sensibilities but to reveal ourselves in the variety of ways in which we appeared to these literate travelers.

Mr. Nevins has divided his samples into five periods, each preceded by a summary analysis of the attitudes displayed by the contemporary writers. Although some themes continue throughout, it is interesting to note the change in orientation as the United States grew in complexity and power. Perhaps the most abusive period was from 1825 to 1845, which Mr. Nevins calls one of Tory condescension. Here is where the notorious book of Mrs. Trollope falls. It is, perhaps, unfortunate that the most virulent attacks upon us have been best and longest remembered, for there have been many notably accurate and sympathetic appraisals of our national character from British pens.

In reading so many accounts of the same subject, one cannot help being impressed by the degree to which each writer unconsciously projects his own personality. Often they are more revelatory of the author's prejudices and conditioning than they are of the object's characteristics.

Although the editor refers to the undiminished flow of British books on American travel, I found on the contrary an interesting pattern in the frequency of their appearance. The bibliography contains almost 400 titles, selected by Mr. Nevins to cover all of the most important items. Although these do not exhaust the list, I tabulated them according to their date of publication and discovered a gradually increasing number, with a maximum of 47 titles in the decade 1850-9, falling thereafter to a minimum of 12 titles in 1890-9 and 12 in 1900-09. In the twenties a minor revival occurs with 33 titles, followed again by a sharp drop. It is tempting to speculate on this curve of production. Does it represent cyclic phases of special interest in us by the British? Or is it merely the effect of developments in transportation?

H. L. Shapiro

MAN IN THE PRIMITIVE WORLD

-------- by E. Adamson Hoebel

McGraw-Hill Book Co., $5.00
543 pp., 73 figs.

THE rapid increase in the teaching of anthropology in colleges within the past few years has been accompanied by the appearance of excellent textbooks—so many, in fact, that authors seem to be running short of appropriate names. This title seems a little ambiguous. This most recent book by Hoebel is a comprehensive treatment aimed at undergraduate students and average readers. As anthropology becomes more and more a subject to be taught to undergraduates, and perhaps eventually to high school students more books of this type will be needed.

The book is divided into five parts. Part One is a brief definition of anthropology and a discusion of the subsidiary disciplines. The history of man and his culture are outlined in Part Two. Part Three discusses the races of mankind and gives a very adequate and well-balanced presen-

Continued on page 96

The amazing life story of one of the greatest explorer-archaeologists in history

Frederick Catherwood, Arch$^{\underline{t}}$

by VICTOR WOLFGANG VON HAGEN

- This engrossing biography contains all the known original material on the fascinating life of an extraordinarily talented and tragic figure.
- Not only was Frederick Catherwood an outstanding authority on the civilizations of the Old World — Egypt, Greece, and Arabia: he was also one of the leading figures in the history of the discovery of Mayan culture in Central America. This book restores him to his proper position in the Mayan field.
- Mr. von Hagen, himself a noted explorer and archaeologist, tells the story of Catherwood's explorations on two continents, his many strange adventures, his associations with famous men of his time in Europe and America, and of the evil star that followed him until his disappearance on the *S.S. Arctic.*

A feature of the book is the reproduction, for the first time since their original publication, of Catherwood's noted series of 24 lithographs—"Views of Ancient Monuments."

208 pages, 64 pages of illustrations, frontispiece in color.

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OXFORD UNIVERSITY PRESS
114 Fifth Avenue • New York 11, N. Y.

Those Barotse!

An epic journey by a band of African natives, who walked 500 miles in starvation, peril, and exhaustion to join their white friends

By Margaret Hubbard*
Hubbard expedition photos by Arthur Mencken and George Noble

▲ Courage, honesty, and undying loyalty are some of the qualities that win admiration for the Barotse. N'Yambe is here shown bringing long grass to make a camp bed

We had sold to the Pretoria Zoo all the animals collected during eighteen months in Northern Rhodesia. It was a blow, for we once had hoped to bring them to zoos in the United States. But we were broke. Then our spirits were lifted by a friend's offer to back us in another try, and this time we were also going to take moving pictures of the game.

After months of preparation, all was ready for our move to the fabulous west—to the country beyond Namwala on the Kafue flats, beyond Kowetu, out in the spaces empty of villages toward Mankoya, where the game was thick and undisturbed. Out there, hunters told us, the lions walked boldly at four in the afternoon; and Sajetema, the father of all elephants, whose tracks one knew by the crack across his right hind foot, roamed immune from harm. If he heard natives chopping wood, he came on the run to toss and trample them to death for daring to invade his kingdom; and should a man fire on him, the bullets would turn to water. Or so the natives said. The region sounded like a paradise of game, ideal for our purpose.

We planned to make a base camp close to water, where there was shade and a breeze and where we could plant a vegetable garden and make a home of sorts for the children. If your son were born in Northern Rhodesia and had known nothing but the freedom of the high veld and the constant watchfulness of a devoted nurseboy, it would not seem alarming to go still farther into the bush; so I had no fears. By that time, I was well versed in precautions and the technique of nursing malaria and dysentery; the babies were fit and the rest of us in good condition.

As to lions, leopards, and such dangers, I had learned that the difficulty is to find the brutes instead of fearing they might find us. After all, I reasoned, if great-grandmother once rode horseback from upper New York to Iowa, and if others once took their children across the Great Plains in the face of hostile Indians, why couldn't we go into a wilderness where only the animals were wild and shy? No. We discounted imaginary dangers and took precautions against what few risks there might be. If game were there, as hunters said, we would find it and produce the pictures. If we had a worry, it was about the capacity of the cameraman coming to do the photography. He was the risk, not the game or the country.

We had not considered the impact of another venture such as ours. Far to the north another American had photographed animal-catching by methods so crude and cruel that Africa was shocked and outraged. And although for two years we had had permits to capture animals for zoos, the Governor responded to public opinion and stopped all such operations in Northern Rhodesia. To this day, our predecessor's pictures may not be shown in Kenya.

Yet what of our organization and our hopes and plans? No matter what had happened to the north of

◂ NO TASK was too dangerous or exhausting. *Left to right*: the seventy-year-old Mudalla, who grew "very hungry"; Shilling, who would give his life for the babies; Mengeneera, who tossed a deserter over the fence; and Johnnie, who died of "witchcraft"

▾ A BAROTSE on tom-tom

us, we could not give up. This opportunity was our bonanza.

At last we were given permits to photograph and capture what game we wished in Portuguese East Africa, in a territory northwest of Tete on the Zambesi River, where game conditions were said to be unexcelled.

We had, of course, no choice. Surrender was impossible; and at the time no other area was open to us, although the journey would eat into the dry season and the expense of it was an added burden. Nor did we know anyone who had been into the area to confirm the reports of the game, nor did the officials back in Lourenço Marques have any idea of traveling conditions. This was before there were motor roads, and the shortest route to Tete was by rail to Shamva in Southern Rhodesia and thence a walk of about 300 miles overland. From Tete we could work upcountry another 100 miles to the Ruio-Capochi district, wherever that might be. In the opinion of the Portuguese officials it was back of beyond.

Much as we wished, the expense of the move made it impossible for us to take with us all our most dependable boys. After long thought and difficult choice, we named five. I put Tickie first, the nurseboy whom I had trained to care for the babies; then Capaso, the washboy, who doubled as cook, nurse, tentboy, or in any other task about camp. Mengeneera was indispensable as a hunter, and Johnnie was a strapping, fearless Barotse. Charlie, the headboy, ran a peaceful compound and, moreover, came from Portuguese territory, so he was needed.

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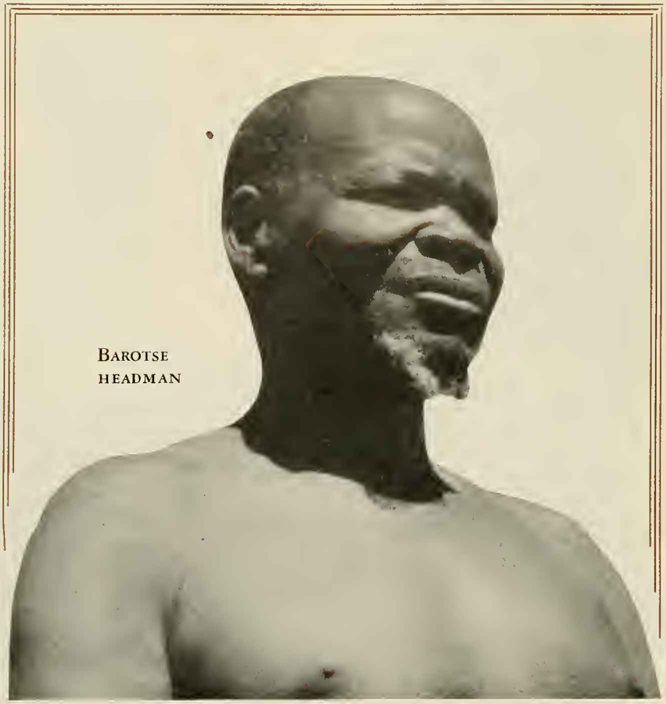
*MARGARET CARSON HUBBARD has covered Africa from the Cape to Cairo. She has lived in various parts of the continent for years at a time, and her son was born in a mud hut at Tara in Northern Rhodesia. Mrs. Hubbard has written two books on Africa, *No One to Blame* and *African Gamble*, and has made motion pictures of the animal and native life in Northern Rhodesia. She worked with Military Intelligence on African areas and has served as Vice Consul and Economic Analyst with the U. S. Legation in the Union of South Africa.—ED.



BAROTSE HEADMAN

The faces of the others dropped when we gave them the decision. But the next morning seventeen came to us with their thoughts. Mafaeking, another Barotse, stepped forward to act as spokesman. He was an upstanding man with an open face and a determined chin.

"We understand the railroad costs too much money for all of us. But we do not wish to stay behind. If we walk to where the Inkos leaves the railroad, may we go with you? You will need carriers, and we will carry."

"Walk?" We were dumbfounded. As the crow flies, it was all of 300 miles from Choma to Shamva and nearer to 500 or 600 miles by the trail they must follow. There were mountains to climb, up and down the hard escarpment; the Zambesi Valley had to be crossed, where the natives were truculent and big game a possible danger; and then there was another climb to the plateau and Shamva. When they reached us, there would be still another 400 miles to cover, yet they suggested this jaunt of nearly 1000 miles as though it were no more than going down to the corner store.

"You will need carriers," Mafaeking persisted. The group behind him nodded vigorously. "If you can give us salt and tobacco to buy food, we will come. We do not want to be left behind."

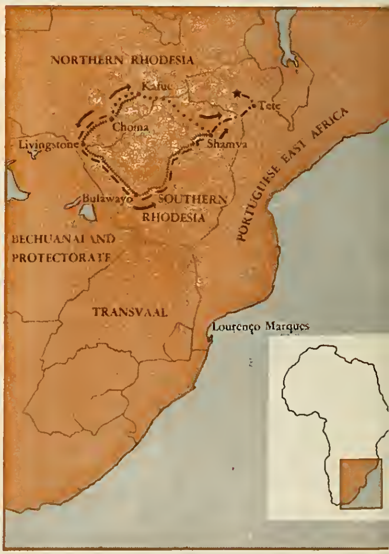
It was not high wages that were luring those boys. We paid most of them the standard ten shillings a month and their food, which could be matched by any employer in Northern Rhodesia. They had more meat to eat in our hunter's camp than on the average farm, but no one, surely, would walk 1000 miles for meat. The fact remained, however, that they wanted to stay with us and we wanted them—the cream of the compound, most of them of the Barotse tribe.

Mafaeking was a good hunter and a good worker. Matches, about seventeen years old, was my cheerful tableboy. There was Saiman, who had a way with animals; and even the Mudalla, of the crumpled shoulder, where a lion had bitten him. He was 70 if he was a day, but the old man grinned and assured us that the walk would be a mere nothing for him. There was his devoted brother, Shilling, and Kapatan, Towelo, Momborowa, and others—the boys we would have chosen if we could have afforded to take them.

Leaving day approached, and we measured out more than enough coarse salt and tobacco to see them through their long trip, and a few shillings apiece to take them up the railroad a short distance to cut 100 miles off their walk.

Two weeks later the railroad was behind us and we were camped on the Mazoe River, in Southern Rhodesia, busily organizing for the long walk to Tete. Our first need was carriers, 50 or 60 of them, to move all the duffel we needed to see us through and to establish headquarters and take pictures—camp equipment, rifles, ammunition, cameras, film, a few clothes, our own food, and food for carriers. A 200-pound bag of meal fed 50 boys for two days. Trade goods—calico, beads, and salt—were needed in quantity to exchange for food on the road, and in addition we would have to carry some meal to feed our boys

▼ FROM CHOMA, the natives followed dotted line, the expedition the dashed



◄ KAPATAN (*right*) and another Barotse stripping bark to make ropes before the heroic journey into Portuguese East Africa

▼ MAKING HEAD RINGS from bark for carrying loads

in case we struck a barren area. No one in the district could tell us of conditions on the trail, for no one had made the trip, nor had they heard of anyone who had walked to Tete.

Boys poured into camp from Nyasaland and other points north, looking for work on the mines. Many of them would have taken work as carriers, but when we said we were going to Tete, they lost interest. They would not go into Portuguese territory.

A rough lot, about 20 of them who said they were of the M'Curry Curry tribe and natives of Southern Rhodesia agreed to go with us. But within a few days, when our trade goods began to disappear, we were certain that we faced trouble. There was a thief, or thieves, among them, and our lives depended on having calico and salt to exchange for food. Yet there was no alternative but to keep them on for the sake of their legs and shoulders, which could move our duffel. No boy worth his salt would go into Portuguese East.

One week went by, then two and three, and we began to worry about our Barotse. They should have reached us, unless some misfortune had delayed them.

We had uncovered the thief and put the fear of God into him, but we needed those Barotse more than ever, as a sound core to the good-for-nothings we were forced to hire. Three hundred miles of unknown country lay ahead of us, where there was not a white man, policeman, or magistrate within days' reach, should we need authority to deal with troublemakers. Nor could we desert those boys, although we had no means of knowing where they were, what had happened, when, if ever, they would appear.

Witchcraft! The dread word shuddered through camp when Johnnie, the big, fearless Barotse, discovered he had a tapeworm. Without a doubt, some boy in Barotseland, hundreds of miles away, had put a spell on him. So many things carry death—the chameleon, the rabbit, a snake in the house, a certain kind of snail—before which the boys would cover their eyes in horror and run away. They spoke in whispers, for to speak aloud of the evil would court disaster; nor was it named.

Johnnie thought of his past, thought of someone in his faraway village who bore a grudge. There was no convincing him that he was not doomed, and no word of ours, nor the fact that the worm was removed, put heart into him. Not one boy in the entire compound believed our reassurances. Witchcraft! And there was no witch doctor who knew the medicine to lift the spell. What can a white man know of magic? Ours were empty words, and they watched him, fearfully waiting. The will to die possessed the boy, and when the stars marched across the sky to meet the dawn, Mengeneera came to whisper, "*Ena feelee* [He's dead]."

Johnnie's brothers, the Barotse, had not yet arrived, but Capaso, Mengeneera, and Charlie buried him as a Barotse should be buried. They knew in what position Johnnie should face the east—his legs drawn up as though in his mother's womb.

Of all those in camp, I was the only one who could not pay my last respects, for Johnnie was a man and I a woman, and a man's burial is the business of men. Afterwards, I put a stone on the sad pile of rocks that protected the grave from hyenas and other scavengers, and I had in my throat the same thick lump from which every one of us who knew the boy was suffering.

Five weeks had now gone by, and each day we spoke of the many things that could have happened to the boys we waited to see. At the beginning of the sixth week, when I was looking, as I so often did, up the road by which they should approach camp, I saw some boys coming down the hill, their feet dragging in the dust. Surely it could not be the vigorous boys I knew! They were thin and tired, but nonetheless they were our boys.

Weak voices greeted us. *"Dabonwa Inkossikos. Mabouka Boss."* They sank wearily to the ground, and Mafaeking stepped forward. *"Ena feekilee, Inkos.* [We have arrived.]" We clapped our hands in response to their greeting and waited. They were skin and bones. They had been on the way for six or seven weeks.

"Did we not leave plenty of trade goods?"

"Oh, yes." Again Mafaeking stepped forward, but his shoulders drooped, his face was grayish-brown and drawn. Slowly he told the story.

The morning after we took the train, the storekeeper in whose care we had left what was to be sold, came to the compound and saw the sacks of salt and tobacco and laughed at the boys for liars when they told him we had left those things for them to use on their trip. They would walk to Shamva to join us, would they, and we believed it? We were fools, and he knew natives well enough to know that the thieving bastards would not keep their word. He confiscated the salt and tobacco.

"We had said we would come," Mafaeking continued gravely. "As we said we would do, we took the train to Kafue and started our walk from there. You had given us money for our tickets, and the storekeeper did not know we had it."

They reached the Zambesi Valley and found the villagers starving after a bad year. There was very little grain, and what little they would part with, they sold at a price. A blanket for a mere double handful of grain! They spent the few shillings they had saved from months of pay. They sold their blankets, their shirts, their shorts. They went on starvation rations, but even so they twice lived for three days at a time on roots and grass and water.

"We saw much game!" Mafaeking's eyes shone for an instant. "Where the Kafue and the Zambesi meet, we saw elephant with tusks so long." He measured his arm from his shoulder. "Many of them."

He went on: "The dogs we were bringing you died of starvation, but six puppies were born on the road, and Saiman, caring for them when he had food, saved three."

The whimpering little bags of bones crouched in a bark basket, which he had carried for weeks on an empty stomach. He laid them at my feet.

Shorn of blankets, money, everything but the rags they stood in, they had reached Sinoia, in Southern Rhodesia, and had gone to the Native Commissioner to ask for word of us. All during their journey they feared that we might have given up hope and gone. The Commissioner at Sinoia knew nothing of us, nor of our journey, but they were detained for two weeks. First they were vaccinated.

"We understood that," Mafaeking explained. "We know that all boys coming into Southern Rhodesia must first be scratched against the sickness. But when that was done, we were not allowed to leave." Mafaeking's voice was bitter. "The Bwana made us work. He fed us, but he did not pay us, and he told us you must have gone and that he would find work for us. He told us that if we did not work, we would be sent back to Northern Rhodesia

◄ A FIGHT in Barotseland. In a crisis, 17 Barotse subdued 60 natives of other tribes to quell a mutiny and see the expedition safely into Portuguese East Africa and that we would have to walk again through the Zambesi Valley. Many white men came to see us. They said they would give us fifteen, twenty shillings a month to work on their farms. Barotse are known." Mafaeking drew himself straight, and pride rang in his voice. "We said that we had work, with you. We said that you would not leave us. So at last we were allowed to go. We have walked seven days from Sinoia, and now we have arrived. That is all."

To look at their gaunt faces was to know that every word of the story was true. Matches looked ten years older—no longer the plump, laughing youngster I had left in Choma. Only the wrinkled, seventy-year-old Mudalla looked much as he had. He still clutched his bundle of spears and still wore at a cocky angle the same wreck of a straw hat with a feather in it. More than once in his life he had pulled his stomach against his backbone, and it would take more than a hungry 600-mile walk to finish him. "I am very hungry, boss!" He clutched his stomach and spread his sardonic grin.

Matches dug down into his *chiapaupau* and brought out a plated silver teaspoon. "You forgot this in Choma, Inkossikos," he told me. "I brought it to you."

I could have cried. He might have traded the spoon for a square meal and I would not have known, or cared.

"Thank you." What was there to do or say in reply to the saga of complete loyalty? We gave them blankets, clothes, the money they had spent, and told them to eat and sleep until they felt like moving. Every face wore a smile. "Thank you, Inkos!" *They* thanked *us!*

Even grief over Johnnie's death could not darken for long their zest for living. They had been hungry, but they were no longer. They had been afraid, but the dangers were past. In three days, they said they were ready to go, and when the packs were lined up, it was those Barotse who took up the heaviest, most awkward bundles.

"*Hi! Yi! Yi!*" The shrill yips and shouts of laughter, with which they always started a journey, echoed against the hills across the river. "To Portuguese! To Portuguese! *Yi! Yi! Yi!*" Saiman, Matches, Kapatan, and Tickie took up the crib in which the children rode. We were off!

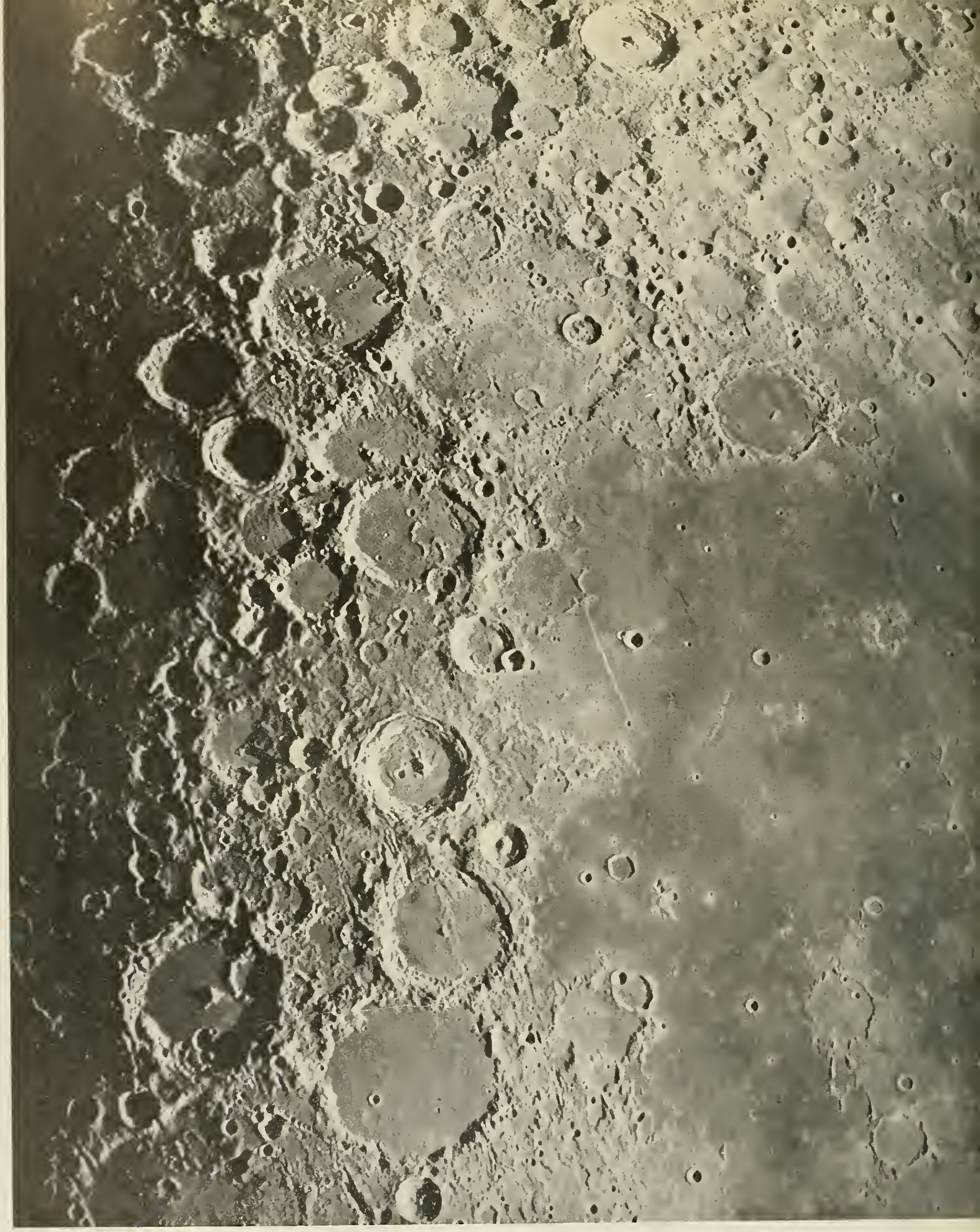
Two weeks later, we should have been well into Portuguese territory, but we had not yet crossed the Luio River and the border. In this rugged, rocky country food was scarce, and we had to trade exorbitant yards of calico for what we could buy. Some villagers even covered the water holes until we paid to learn where they were hidden. We lost days hunting for meat, as most game had left the dry country. Our trade goods were perilously low, and there was muttering among the M'Curry Curry. Without food, and plenty of it, those boys would not carry 60 pounds apiece for many more days, and without carriers we would be stranded days from any place.

We climbed down, down, down from the plateau and came, at last, to a sandy river bed, the Luio. Great oval marks were pressed deep into the sand. Elephant! We wound

Continued on page 93

▲ KASONDA taking a bird from a snare

◄ KASONDA shows the typically open, cheerful face of the Barotse



▲ Dark spots, suggesting a low but persistent form of vegetation, are observed on the floor of the crater Alphonsus (where the arrows would meet). They are known to vary. This is in the south-central portion of the moon

How Dea

s The Moon?

Strange occurrences observed by astronomers indicate that the question of life on the moon is not a "closed book"

By Paul M. Sears

Photographs courtesy of Mt. Wilson Observatory

The moon has long been considered a dead world, airless and lifeless—a world where nothing ever happens. Yet puzzling events occur on the moon, as its devotees well know—events as real and unquestionable as changes on Earth from "fair" to "rainy" or from summer to winter.

However, earthly comparisons are misleading, for the moon's climatic excesses are far greater than the rigorous extremes of our deserts, poles, and high mountaintops. The moon's atmosphere is so thin that its existence is still occasionally doubted by scientists—though not by those familiar with the moon from many nights of observation.

The lunar atmosphere has a surface density only one ten-thousandth that of ours, a gaspingly thin prospect for space explorers. Yet this meager moon-air diffuses the advancing light of the sun and casts a pale dawn over the dark and frozen regions beyond the "terminator"—that is, beyond the line that divides night from day on the moon. To see these elusive dawns and twilights requires patience, knowledge, and rare good fortune. Ten favored astronomers in the last 150 years have glimpsed the lunar dawn as a faint prolongation of the bright horns of the crescent into the dark-moon disc, on nights of exceptional seeing, with the "old moon in the new moon's arms."

Not only twilights demonstrate an atmosphere on the moon. Far more spectacular proof has appeared recently with observations of bright moving specks against the "old moon," which must be luminous meteors in the lunar air. These were discovered not by chance but by careful deduction and painstaking search, reminiscent of the effort that resulted in the discovery of the planet Pluto.

The search was based on the knowledge that eight or ten meteorites strike the Earth each day, while many millions of smaller ones are consumed as luminous streaks in our atmosphere, yielding only a fine metallic dust which drifts down upon us steadily from the stratosphere.

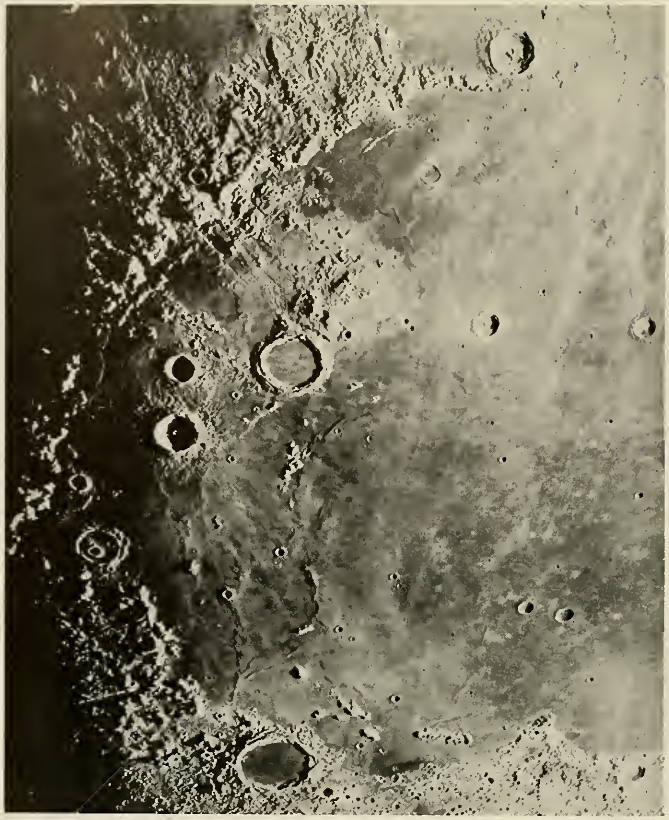
In the 1930's, lunar astronomers began to speculate on the fate of the meteorites which they knew must be striking the moon. Dr. Lincoln La Paz, then of the University of Chicago, made calculations which showed that meteorites weighing ten pounds or more, falling on the dark portion of an *airless* moon, should disintegrate in a flash brilliant enough to be seen with the naked eye from Earth. Over 100 such flashes should occur each year, and they should be seen not only by astronomers but by strolling lovers, outdoorsmen, navigators, and other well-placed observers. We know that such "lights on the moon" are not ordinarily seen; however they *have* been reported two or three times in all human history – just often enough to persuade us to be tolerant of the medieval artists who placed stars within the arms of the crescent moon.

All this was further argument for the existence of the moon's atmosphere, on the grounds that most of the moon's meteorites were being consumed in its gaseous envelope before striking the surface. Indeed, the moon seemed better protected from falling meteorites than the Earth, for, with only one-sixth the gravitational pull, the moon's atmosphere is far less concentrated toward the surface. At some elevation, estimated at between 43 and 55 miles, the atmospheres of both Earth and moon have the same density. Above that height the moon has the denser atmosphere and is thus better able to destroy meteorites at great heights.

The question remained: Might not the meteors flaring through the moon's atmosphere be visible from Earth? Calculations showed that the very brightest meteors on the moon—those that would be reported as fireballs if they occurred on Earth—should be faintly visible through telescopes.

Accordingly, in 1941 Mr. Walter Haas, Publications Editor of the Association of Lunar and Planetary Observers and one of the most experienced students of the moon, began an extended search for lunar meteors. In 170 hours of searching the dark portion of the moon, Haas and his associates detected 12 bright, moving specks which began and ended at points on the moon visible under the telescope. During these observations four or five of our own meteors crossed the telescopic field—meteors flashing in the Earth's atmosphere overhead. One or two of the lunar flashes may also have been extremely faint earthbound meteors coming almost directly toward the observer, but the laws of probability indicate that most of them occurred on the moon.

In addition, the search for lunar meteors revealed two momentary



◄ THE MOON has generally been thought to have no atmosphere, but clouds occasionally obscure parts of the great crater Plato, at the bottom of this photograph. This view of the moon at the last quarter shows the lunar Alps and Appennines in bold relief

bright points of light on the moon, which may have been true impact flares of great meteorites.

There is some possibility that these stationary flares were brief volcanic eruptions, for certainly vulcanism has played a part in the history of the moon. Early astronomers thought the vast dark areas of the moon to be seas and gave them fanciful Latin names such as Mare Serenetatis and Mare Nubium—Sea of Serenity and Sea of Clouds. Better telescopes of more recent years have shown the seas to be rock-paved areas, evidently lava flows, which in some cases breached and half obliterated nearby craters. In places, pressure ridges buckled the surface as the lava lost its fluidity and fell prey to stresses of the disturbed lunar crust.

More debatable is the origin of the 30,000 craters that have been charted on the moon. Geologists, mathematicians, and ballistics experts, as well as plain astronomers, have speculated on the forces that blasted out the craters. The trend of speculation has alternated between two theories—that the craters are volcanic or that they were created by the impact explosions of planetesimal fragments. Perhaps no one theory can account for all the craters; they range in size from pits a few hundred yards across at the limit of telescopic visibility, to huge ringed plains a hundred and fifty or more miles across, with mountainous walls often thousands of feet high.

Indeed, the moon's topography is certainly more complex than the telescope reveals, for the full moon is nine times as bright as the half-moon, and this can only be explained by a highly irregular reflecting surface—perhaps a surface crowded with tiny pits. We must imagine the moon to be a place of precarious footing indeed!

Bizarre events occur in this world of jumbled terrain and tenuous atmosphere. Each month, strange dark areas known as "variable spots" spread and grow, becoming darker relative to the rest of the moon's surface as the sun climbs higher. Some of the variable spots fade again toward sunset; others continue steadily to darken until they are lost in the chill shadow of night. The size and shape of a variable spot may differ from one month to the next, and indeed some spots occasionally fail to appear at all.

The variable spots do not occur in the polar regions of the moon, and they seem to prefer protected sites, such as the depressed floors of the great lunar craters. Their behavior suggests a low but persistent form of vegetation, adjusted to fourteen-day cycles of alternate growth and rest but tolerant of great extremes of heat and cold. Should there be life on the moon, we can expect the lunar day and night thus to correspond biologically to summer and winter of an earthly year.

Faint clouds occasionally drift over the moon's surface, obscuring local details of topography. Sometimes these clouds are outlined on one edge by their own shadow. Lunar clouds are never large, and they dissipate quickly—usually within an hour or so. While the moon scarcely has spells of cloudy weather, the clouds do show preferences for certain regions, which have become famous among lunar observers. Half a dozen astronomers in the last century have seen the mist that occasionally hides details in the 3000 square-mile floor of the great crater Plato, in the far northern latitudes of the moon. Clouds in certain other craters occur much more frequently.

The surface features of the moon are variously colored, and the colors themselves are changeable. Elusive tints of green, brown, and purple, and more rarely of blue and violet, cover great areas during each lunar month, usually appearing in the same places but varying in extent and duration. Different colors may succeed one another in the same region during the lunar day. Crater floors at sunrise and sunset are usually green; under a high sun they may be green, brown, or purple.

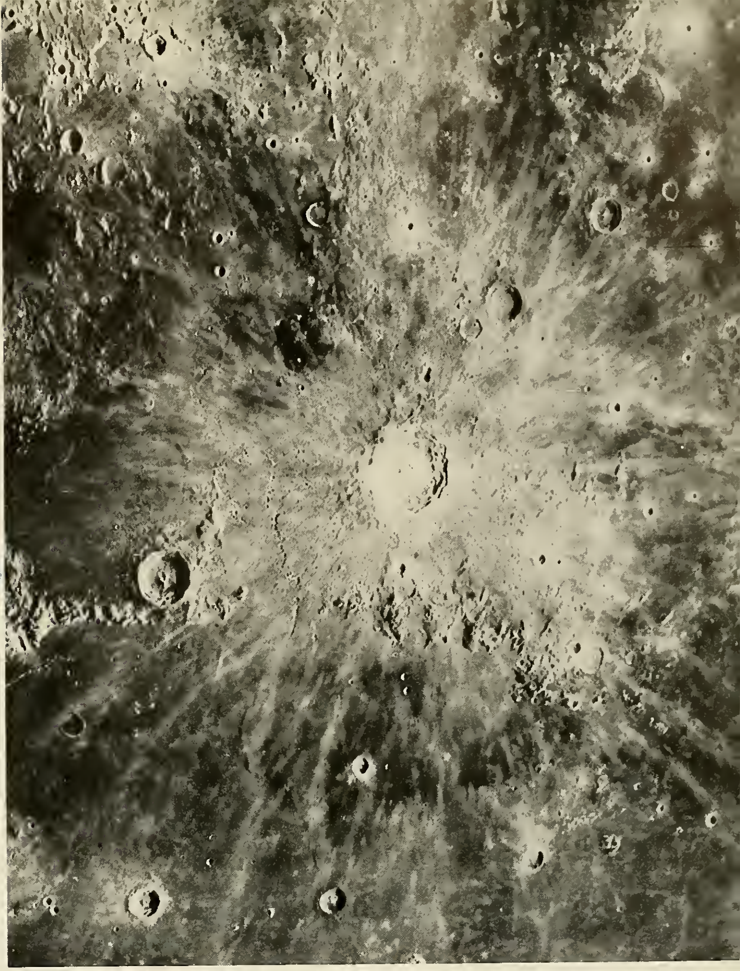
The craters and mountains themselves are subject to drastic changes. The tiny crater Linné, on the vast lava flow of Mare Serenetatis, has disappeared for months and years at a time and then reappeared with greatly altered dimensions.

Most lunar features show no changes after an eclipse of the moon, but Linné reacts violently to the sudden chill and darkness of such an event. During eclipses the surface temperature of the moon drops from around 214 degrees F. to −143 degrees, recovering quickly when sunlight returns. Linné usually emerges from the Earth's shadow with the bright area around its crater greatly enlarged. The area returns to its customary size only after an hour or more in the sunlight.

Observing the moon is not easy. Changes in the shape and brightness of a single lunar feature require the attention of an experienced observer for an entire year before his findings are credited. The neophyte has no small task merely learning the rudiments of the moon's geography, including the locations of the 600 craters prominent enough to have been individually named. Excellent seeing conditions occur in most localities only two or three times a year. An observer must be alert for favorable nights, when fuzzy spots that have strained his eyes many times before suddenly and briefly clarify into definite craterlets or pits or ridges.

More detail can be seen in any fair-sized crater of the moon than on the entire surface of the planet Mars. These details must be sketched at every observation, for the human eye is far superior to photographs in studying minute telescopic objects. Most astronomers use only one eye for their work, some preferring the right, some the left eye. Seasoned observers are convinced the preferred eye is the only one that "learns" the moon. When they look with their "off" eye the moon seems uncomfortably bright and its detail blurred.

Scarcely one astronomer in six today is on familiar terms with the moon. The great telescopes of the world are employed in the study of distant regions of the Universe, and only scattered observers – mostly amateurs–keep alive the older study of the moon. Their enthusiasm is understandable, for less than one-tenth of the moon's visible surface has been studied systematically. Any persistent observer may discover a startling event on the moon, tonight, or the next night, from his own back yard.

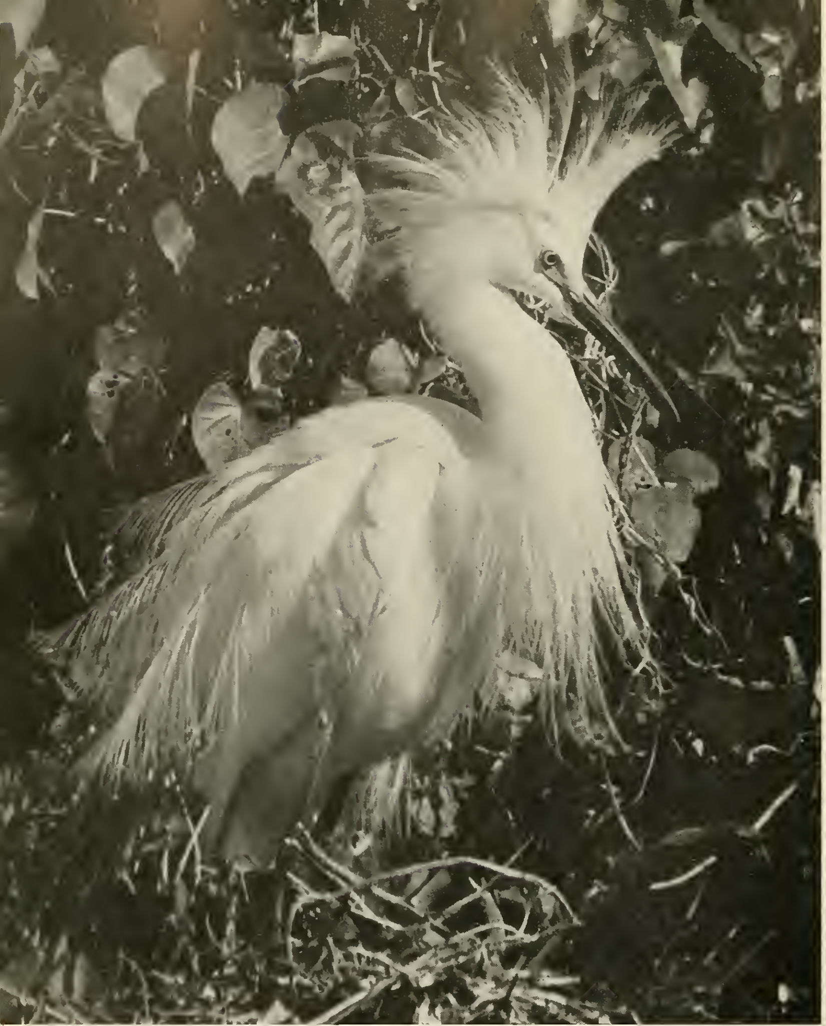


VARIABLE DARK SPOTS appear under a high sun in the crater Eratosthenes, the prominent one to the left of Copernicus in the center of this picture

Bird

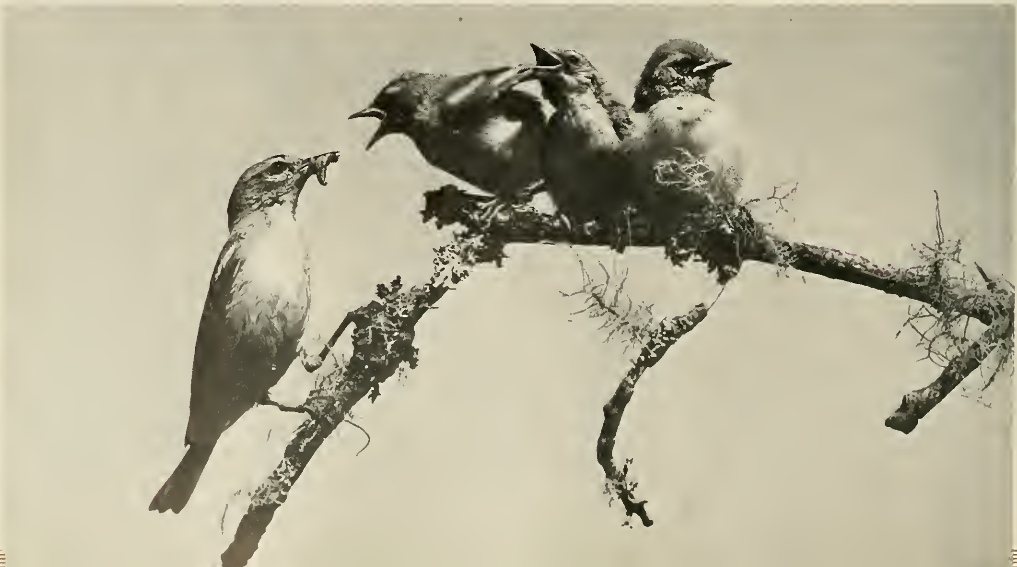
b

The exhibit from which these photographs are selected will be open to the public at the American Museum from February 8 to March 5.



◂ Snowy Egret
in the Everglades of Florida

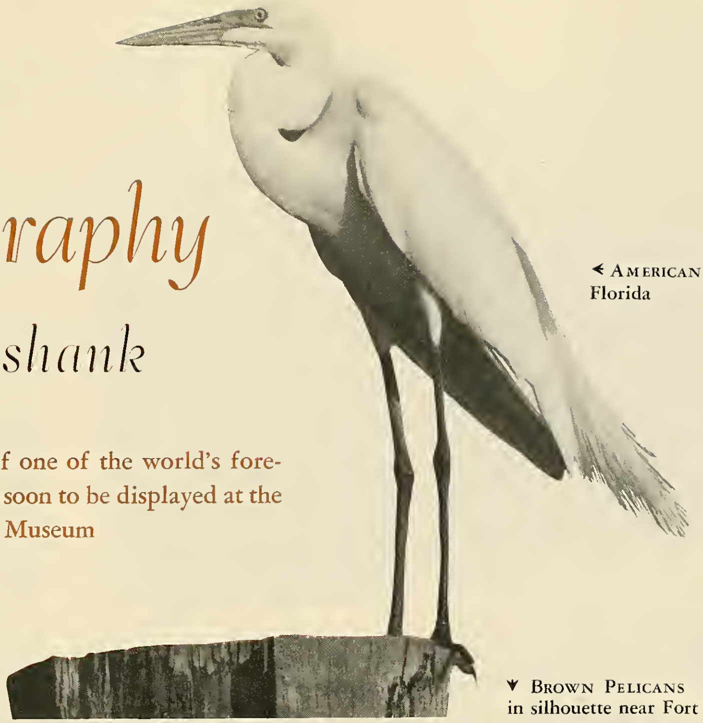
▾ Parula Warblers
at Muscongus Bay, Maine



Photography

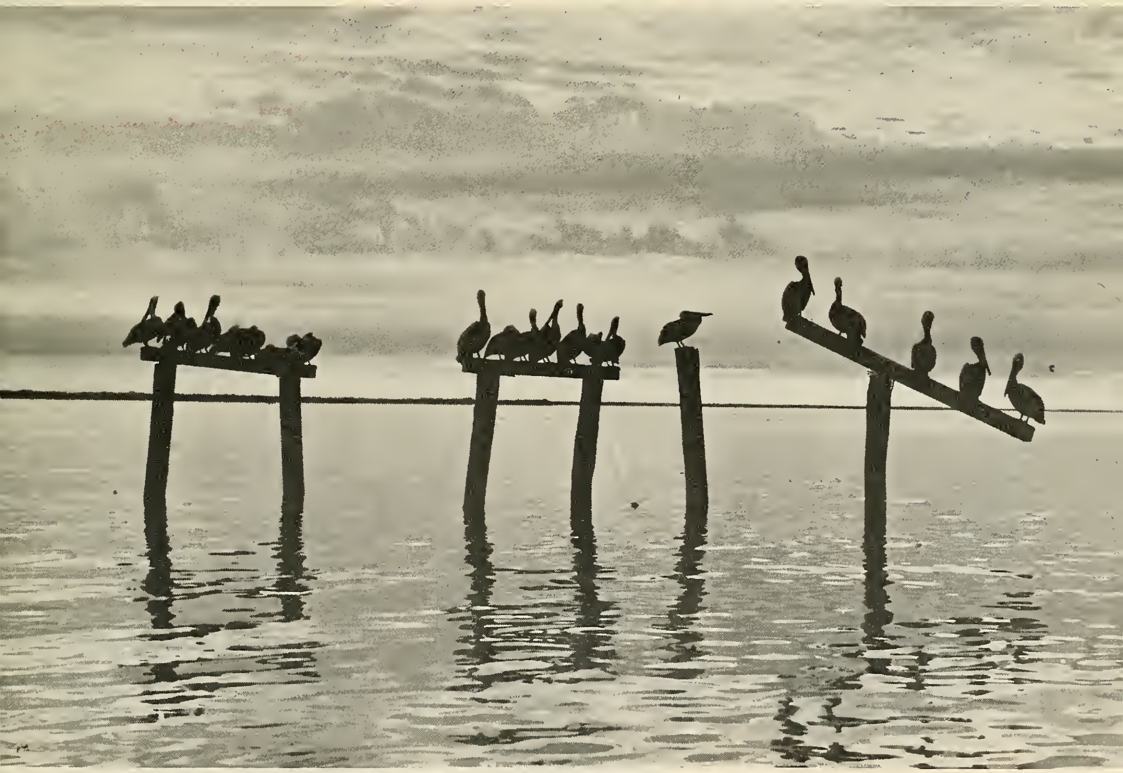
llan Cruickshank

Selections from the work of one of the world's foremost nature photographers, soon to be displayed at the American Museum



◂ AMERICAN EGRET—
Florida

▾ BROWN PELICANS
in silhouette near Fort Pierce, Florida



Mme. Eskimo Prove

When the women of Nunivak Island suddenly found an artistic opportunity, fascinating figures ranging from centipedes to whales appeared on their baskets

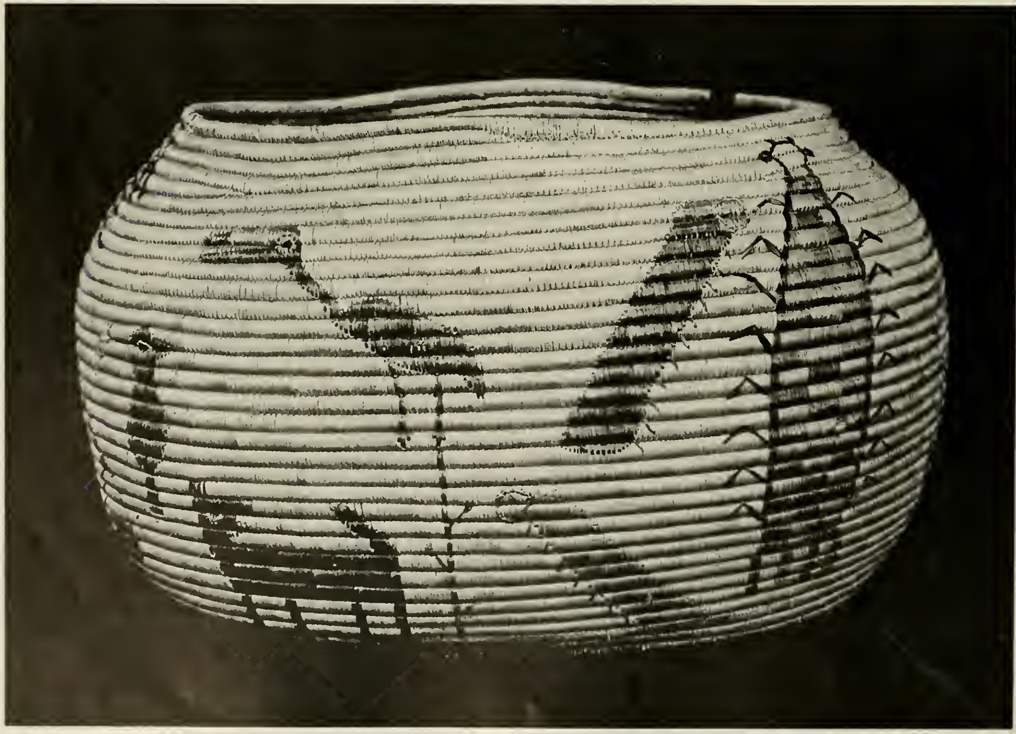
By MARGARET LANTIS[*]

Illustrations from the author's collection

ESKIMO women around the east side of Bering Sea were underprivileged, inhibited, and inexpressive right down to the 1920's—but only aesthetically, one must understand. In everyday chores they were unusually competent and independent, and they certainly were not depressed people. In art, however, they could only stand around and admire the men's creativeness. Men carved and etched dozens of things, from walrus ivory. They carved ornaments; handles for buckets and bags; snow knives for cutting and scraping snow; points, heads, prongs, and foreshafts of long ice chisels; meat hooks and ice hooks; bird spears, fish spears, harpoons, and other implements. They made fancy tubular containers for the women's needles, and above all they carved the amulets, or charms. These were worn on the body and tied on all the hunting and fishing gear. They were carved in the likeness of worms, bears, men, birds, or almost any other creature that could hold and give one some particular power when it was needed.

The men carved wood, too, their most spectacular products being masks as much as three feet high and elaborate in proportion. The wooden dishes, buckets, cups, and spoons, from which everyone ate, were not only carved but painted with animal designs.

And what did the women make? Clothing, skin sewing kits or



AMNH photo

▼ BIRDS, INSECTS, and four-footed animals, neatly and artistically woven into the new-style coiled basketry, gave artistic expression to graphic talents originally developed only as childhood pastimes. This is an enormous basket about two feet in diameter

Herself an Artist

"housewives," small fur bags or pouches to hold trinkets, and occasionally an elaborate dance headdress. However, before trade brought tiny Czechoslovakian beads, American buttons and red flannel, and perhaps Canadian yarn, the clothing was very plain. Fancy borders on the garments, with designs worked in contrasting colors of "fur" (usually tanned calfskin imported from the States) are familiar today on parkas and boots but were not made in pre-Discovery times.

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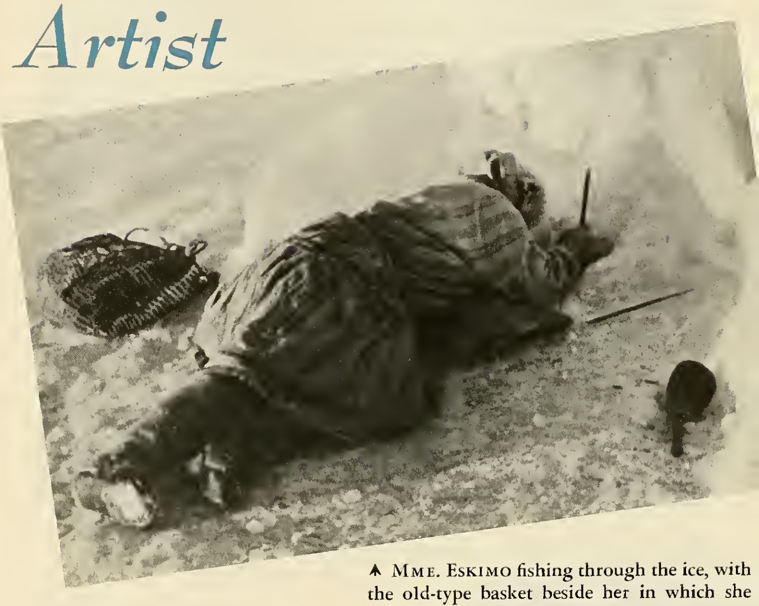
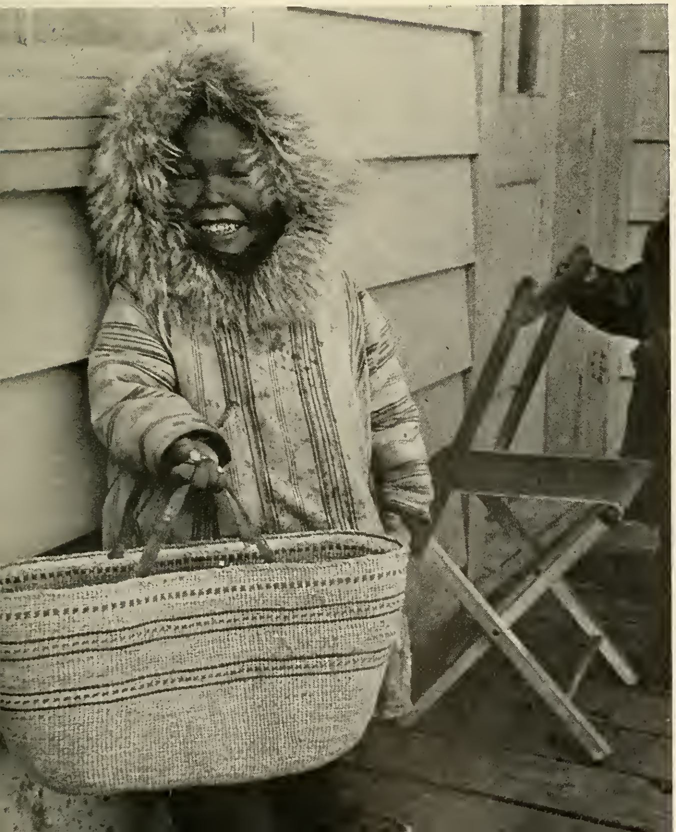
* MARGARET LANTIS is the author of several important works on the Eskimos and has made two visits to Nunivak Island, including a year in 1939-40 and three months in 1946. Readers will remember her previous article in NATURAL HISTORY for October, 1941: "No Wonder They Worship the Seal."—ED.

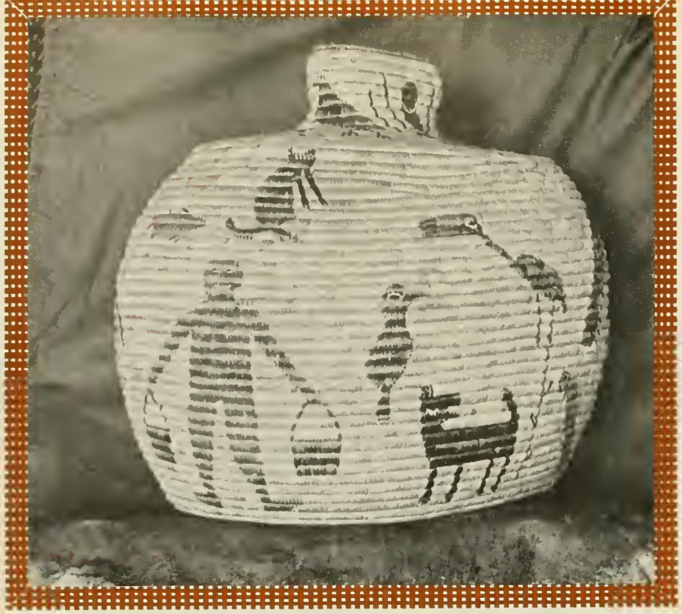


▲ MME. ESKIMO fishing through the ice, with the old-type basket beside her in which she will carry home the tom-cods she is spearing

▼ THE OLD-STYLE UTILITY BASKET was always made in the two-strand-twine technique



▼ FRINGED MATS, big and coarse, that cover the dried fish show the long Wild Rye (*Elymus mollis* Trin.) from which most baskets are made



▲ **Almost any figure** common to daily experience may be worked into the modern coiled basketry of Nunivak. Naturalistic designs like these were formerly the special privilege of the men

AMNH photo

▲ **Another example** of old-style weaving: grass socks from Nunivak, representing the era when the women concentrated on clothing and the men had a corner on the graphic arts

The women had to be content with admiration for their finely stitched seams.

Women did prepare and stitch the skin covers on the kayaks, but men painted the totemic designs on them. Women made skin water-bottles, but men carved neckpieces and stoppers for them. A woman would skin the animal to provide the head for a drum, but her husband or son painted it with the figures of animals commemorating great deeds in hunting.

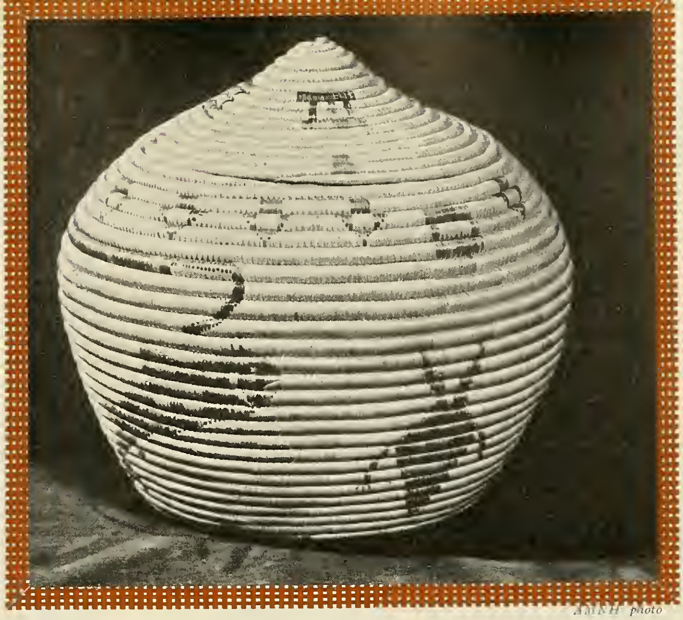
In one craft, though, the men had no part: basketry. Women made fine mats to cover the inner walls of the house and the sleeping platforms; large coarse mats (that were mostly fringe) to keep flies off drying fish and meat; and a more open-weave but nicely made mat to cover the floor of the kayak. They made carrying-baskets of various sizes and fineness, and small trinket-baskets. As the highest achievement of their weaving, they made grass socks and mittens, to be worn inside the fur ones. These were all done in the two-strand-twine technique. Decoration, however, was simple and severe enough to satisfy the most austere modernist in interior decoration. No mythical creatures, with one side of the face looking like a fox and the other side like a man. No figures of seals twisting to escape killer whale or harpoon. Such realistic art was for the men.

Then, soon after 1920, a trader taught some Nunivak Island women to make baskets in an entirely different technique: by coiling spirally a bundle of fibers and then stitching them one coil on top of the other, instead of weaving them by the twined technique. Women on the neighboring mainland had already learned the coil technique, with mixed and not especially noteworthy results. To the Nunivak Island women, however, here was a new medium of personal expression, and they did not waste the opportunity.

By the 1930's, not only were such familiar objects as dog teams figured on the new basketry; much less obvious and seldom mentioned things like crabs and flies appeared crawling up the sides of the meticulously made baskets. Here are some of the creations, artistic or not: a man carrying a fish in each hand, a crane with a fish in its mouth, cormorants sitting on the water, a mythical spirit with his mouth located on his chest, a Christmas tree (of which there are none on the Island), a red fox sitting on its haunches, a beautifully mobile fish about to be speared with a three-pronged fish spear, not to mention the bees and the buttercups. The attentive, accurate observation for which Eskimos are famous was illustrated again in this new medium.

From the alacrity, creativeness, and skill with which the Nunivak women developed and elaborated the new basketry, one might wonder how the naturalistic art of Eskimo culture could have lain latent in the women's minds for so many generations. The answer is that it was much more than latent. It had long found expression in other ways during the formative years of feminine life.

The kind of snow knife that was used in the central Arctic to cut blocks for the snowhouse was used here, where snowhouses were not built, in a fascinating game played by little girls. Father or grand-



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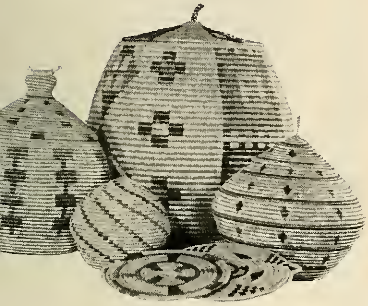
➤ Strangely enough, the baskets bearing naturalistic designs like this one do not attract the tourist trade as much as the type shown below



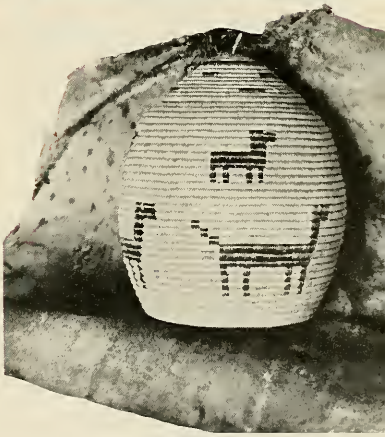
▼ Simple geometric designs like these appeal to the outsider, though their cultural significance is not so great

father would carve out the ivory knife and probably etch pretty designs on it. This was the most artistic plaything possessed by a girl. In playing the game, a girl anywhere from five to ten years old would draw, in sand smoothed by the retreating tide or on untrampled snow, as realistic a picture as she could make. If the snow knife was not at hand, she might draw with her forefinger. She would perhaps picture a house with two children inside, a birdskin parka, a dog with puppies lying beside the house, an old grandmother leaning on a cane. The object of the game was to make other girls guess what specific household, people, or activities the little artist was interpreting. In this example, she had in mind the house of Favorite Daughter, who had two young children and who was busy at this time making a new parka. News items that might not be known to all the children would make the guessing more fun—the fact that the lead dog had recently produced puppies or that granny had just hobbled over for a visit.

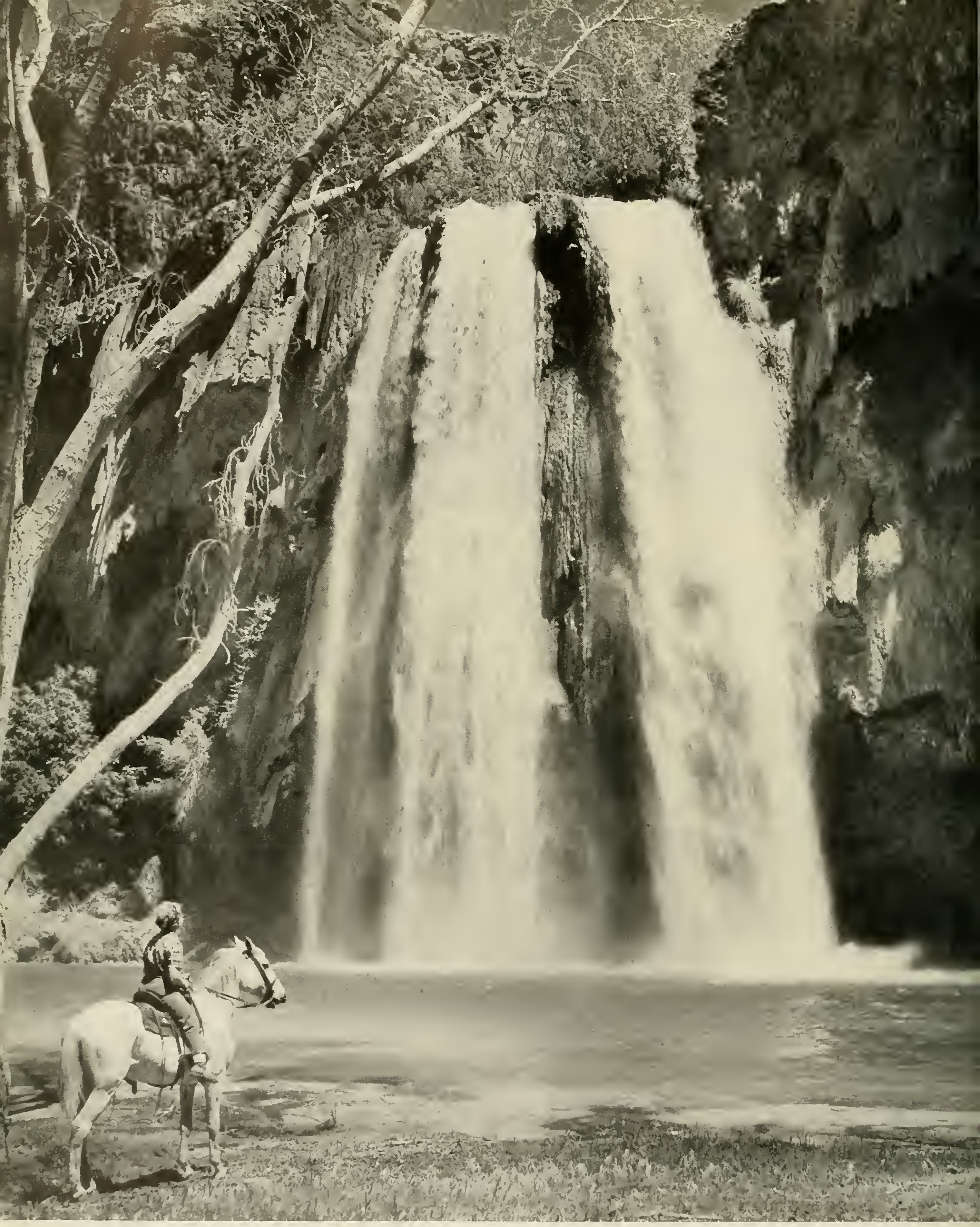
The more exact the portrayal, the easier for one's opponent to guess. So one might wonder that the children should not strive for realism in their sketching. In the old days, though, good workmanship was valued highly by the Eskimos in most of their crafts, and good observation was enjoined in everything, even in childhood games. Hence one played to the best of one's ability, just as today the woman carefully delineates a flying bird when she uses imported colored raffia instead of a snow knife in the sand.

Unfortunately, in the 1940's buyers in the States and even tourists in Alaska looked with consternation at the miscellaneous plants and animals sometimes slapped helter-skelter on the sides and tops of the baskets, and bought the more sedate ones with geometric designs. These have been made from the beginning, along with naturalistic designs, and have at last largely triumphed, although they have virtually no meaning in Eskimo culture.

One might wonder whether, as a compensation, the women would not try to adapt the new naturalistic motifs to the old woven style of basket. Apparently there is not a single instance of this. Even the realistic and adaptable Eskimos have their conservative areas of behavior. The twined basketry looks as it did 50 years ago, unless in the past few months some creative genius has made this combination of old and new. There are always surprises though, as when one first encounters a basket nicely decorated with worms. Eskimo women undoubtedly will find, in time, new ways of demonstrating that they are just as observant natural historians as their menfolk.



▲ Except for details of eye, whisker, or feeler, which are added later, all the figures are stitched on the baskets at the same time as the wrapping of the coils



Josef Muench phot

▲ Havasu Falls: one of the entrancing spots in the desert paradise of the Havasupai Indians. Note the travertine festoons deposited by spray from the sky-blue falls

CANYON Utopia

It is like discovering a Shangri-La right in the United States to visit the Havasupai Indians, who long ago found an idyllic life in a hidden canyon in Arizona

By Philip Ferry

James H. Barbour photo

▲ The Havasupai Indians are friendly and cheerful. They were discovered in 1776 but had little contact with the white man until the present century

THE Supai Indians of Havasu Canyon in northern Arizona have the nearest approach to Paradise to be found on the North American continent. They live in a region of undisturbed wilderness and unsurpassed scenic grandeur. They are wards of the government, and they have no temptations to speak of, since the settlement supports no trading post to dispense those outward manifestations of civilization that might tend to disrupt the fine balance of their tranquil existence. Their tiny post office is perhaps the only one in the country served by pack animal, the mail being brought in over fourteen miles of wild trail from Grand Canyon.

When that brown-robed explorer, Padre Francisco Garces, wandered by chance into the canyon in June of 1776, he found living in that hidden corner of the desert world a tribe of Indians that had never seen a white man. Their legends did not reveal how long they had been hidden in this unexplored tributary of the Grand Canyon of the Colorado. They were the most isolated tribe the Spaniards had encountered in all their wanderings over the great sprawling Southwest.

After Father Garces' visit, we do not hear of the Havasupai again until their canyon was rediscovered by a railroad survey party in 1858. Until early in the present century, there was no regular intercourse with the white man. Then in 1911 a disastrous flood occurred, which prompted the United States Government to send aid and paved the way for a closer contact with the outside world.

Havasu, or Cataract, Canyon, in which Havasupai village is located, is part of the Grand Canyon system, which winds and twists through 100 miles of mesa country amid a veritable maze of smaller but equally enchanting canyons. Some 50 miles west of the settlement known as Grand Canyon, one finds himself in a wildly romantic region in the heart of which lives this interesting tribe of Indians. The Indians call their canyon Havasu, or Canyon of the Blue Water—a highly appropriate name, since the water of the creek is of a sapphire brilliance. The Indians themselves are the Ha-ha-va-

James H. Barbour photo

➤ Descent into the hidden canyon is by a steep trail from Hilltop, Arizona, on ponies provided by the Indians su-pai "The people (*pai*) of the blue (*va-su*) water (*ha*)." This has been compressed until the people have become the Havasupai, or Supai.

To reach Havasu Canyon we turned off U. S. Highway No. 66 near Peach Springs, Arizona, and drove 60 miles across the northern Arizona plateau to a jumping-off place called Hilltop. From this point, a steep trail leads down the red sandstone wall to the village in the canyon below. Over this trail mules carry the few items of food and clothing brought in from the outside world by the fortunate inhabitants of this canyon utopia.

Having motored into Peach Springs, we contacted a representative of the Indian Service, who radioed the agent at Havasu of our coming. By the time we drove the 60 miles from Peach Springs to Hilltop, the Indian riders were coming up the trail to meet us. Riding the familiar small-framed Indian ponies and herding along the pack animal that was to carry our gear, they made a picturesque procession, with the riders silhouetted against the high Red Wall, chanting some ancient tune to speed the animals along. At Hilltop, they tended first to the needs of the animals, then squatted around a small campfire and prepared a substantial meal of barbecued beef, black coffee, and bread.

Gladys V. Broderson photo

▲ THE "SUPAI GODS" look down upon the valley from each side. When they tumble from the sky line, legend says the Supai Indians will disappear from earth

When the meal was over and they had loaded our gear, we mounted and started down the trail. The trail zigzags down the face of the cliff, then runs for nine miles along the floor of Hualpai Canyon, a tributary of Havasu. It is a dramatically picturesque trail, with red sandstone walls towering overhead. At the junction of Hualpai and Havasu canyons, we caught our first glimpse of the village in its enchanted canyon setting.

The little valley in which the Supai live is merely a wide place in the canyon. On both sides rise perpendicular reddish sandstone pillars, which are known as the Supai Gods. Legend says that when these revered pillars fall, the Supai will disappear from the earth. Through the center of the valley runs the tree-lined creek, flanked by cultivated fields and the wooden cabins of the natives.

James H. Barbour photo

Nature has endowed the Havasupai with a healthful climate, a bounteous water supply, fertile soil that is easy to cultivate, and a degree of seclusion that immediately conjures

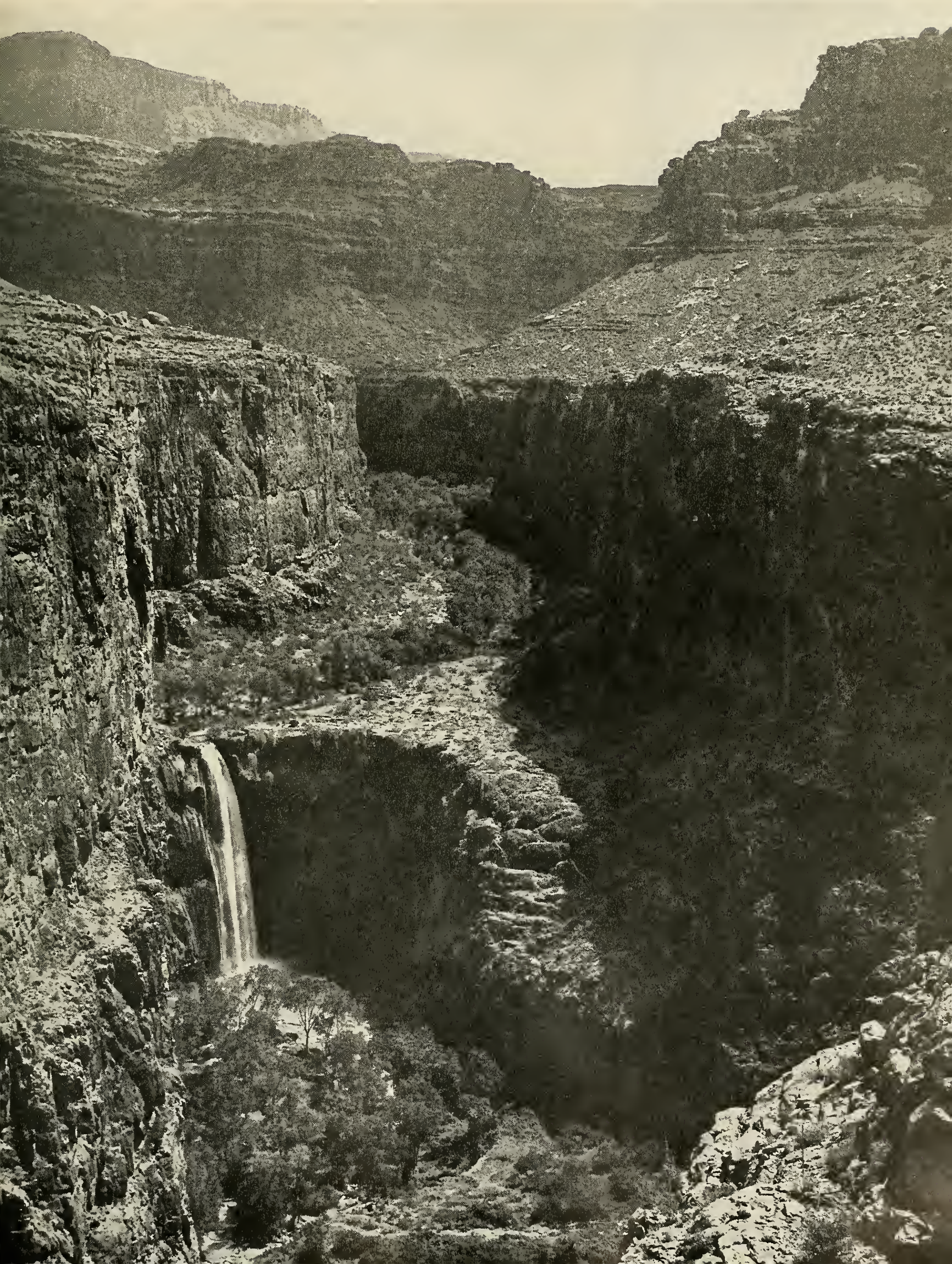
Gladys V. Broderson photo

➤ A VIEW of the cultivated fields and cottonwood trees from Apache Trail. At this point, the Havasupai are said to have attempted to halt raiding Apaches

FROM THE RIM, this tortuous tributary of the Grand nyon appears a forbidding homeland even for a rdy tribe of Indians

▼ BUT WHEN one spies Mooney Falls and its pool of turquoise water, one gets a taste of the entrancing beauty that lies farther upstream, where the village is located

Alfred Schmitz photo



James H. Barbour photo

▲ A HAND CABLE assists the climber in scaling the cliff near Mooney Falls and in exploring the travertine canopies and caves

up visions of Shangri-La. In addition to these practical assets, Havasu Canyon has a scenic grandeur unexcelled in any section of the Grand Canyon country. Crowning all is the series of enchanting waterfalls and cascades that have given the valley its optional name of Cataract Canyon.

The passage of a century and a half finds approximately the same number of people living in the canyon and tilling the same red soil as in Padre Garces' day. The only outward evidences of exposure to the culture of the whites is in their colorful garments and their wooden cabins, which in recent years have replaced the aboriginal brush-thatched huts and log houses. These homes were provided by the United States Government and are not a gift to the Indians. They were built with the understanding that the debt would be repaid at the Indians' convenience, either in the form of cash or "compensatory labor"—work in the National Park, on the roads and trails, etc. While many of the ancient structures remain, they serve as storehouses, granaries, woodsheds, etc. They are not occupied by the Indians.

Since 1910, the population has fluctuated between 170 and 250. At the present time it is 220. The birth and death rates manage to balance each other rather closely, although an occasional epidemic of measles, dysentery, or pneumonia takes its toll. With this small population, some degree of intermarriage is inevitable, although the Supai claim never to marry closer than first cousins. Of late years the men have taken to going outside to pick brides from other tribes, such as the Hualpais and Navajos, though the latter were at one time their deadly enemies.

The grand lama of this desert Shangri-La is the white school teacher assigned to the village by the Indian Service. This agent, whose official title is Principal-teacher in charge of Havasupai Subagency, is teacher, counselor, and friend.

The agent takes his responsibilities seriously and watches over his wards with the single-mindedness of one whose appointed mission is the saving of these people from unwise exploitation. The Havasupai are a simple people, peaceable and submissive. With the Apaches and Navajos raging savagely over the Southwest in centuries past, the docile Havasupai might well have been exterminated had they not found a secret haven in Havasu Canyon. Luckily, the site provided not only a sanctuary from their enemies but a veritable Garden of Eden as well.

Despite the small number of inhabitants, the canyon is overpopulated for its limited resources, and the Indian Service has under advisement a plan that would make the Supai self-supporting without the danger of disturbing the fine balance of their simple existence.

"We are endeavoring to divert national attention away from the people of Havasu and focus it on the beauties of the canyon," Subagent Guthrie told me, "so that future visitors will come to look at the scenery and not to gape at the inhabitants. Altogether too much emphasis has been placed on the people of Havasu Canyon and too little on the canyon itself. Ethnologists say the Havasupai differ little from the Indians who dwell on the plateau above. In fact, they speak essentially the same language—a dialect of the Yuman tongue. However, in the centuries of their isolation they have developed a manner of life that might be the envy of other tribes.

"The scenic attractions of the canyon, including the picturesque trails, the superb waterfalls, and the dramatic walls, are of a nature to draw visitors from every part of the country. A plan has been submitted to the Indian Service proposing the inauguration of a three-day, all-expense guided tour of the canyon region and the waterfalls. The rate would include use of saddle pony, pack animal, dormitory accommodations, and meals."

There are four beautiful falls in Havasu Canyon named, successively, Navajo, Havasu, Mooney, and Beaver—Mooney being named for a prospector who fell to his death over the falls some years ago. In addition to their great beauty, the falls make the canyon a working laboratory for one of nature's most interesting phenomena. The waters of Havasu Creek are highly impregnated with lime, and as the water evaporates it leaves behind a minute film of lime which attaches itself to everything it touches. When solidified, this material is known as travertine. The deposition accumulates in three interesting forms. The first takes place at the waterfalls. In tumbling over the canyon walls, the water releases clouds of lime-impregnated spray, which dash out on all sides. When the water in the spray evaporates, a minute film of calcium is left on the surrounding canyon walls, on rocks and soil, on trees, twigs, branches, and stumps. Everything the spray touches begins immediately to take on an outer layer of stone.

Strangely enough, these calcium deposits do not necessarily kill quickly. The deposition is so slow that the process may go on for years before bringing about the death of the tree. However, since the stream flows the year round, the process goes on endlessly. One of the most interesting phases in this process of accretion is the encrustation of logs and sticks. A dead trunk or a piece of wood may in time become completely surrounded by a shell of travertine, anywhere from an inch to twelve inches in thickness. When the inclosed wood eventually rots away, it leaves behind a cylindrical rock shell in the identical shape of the encased object.

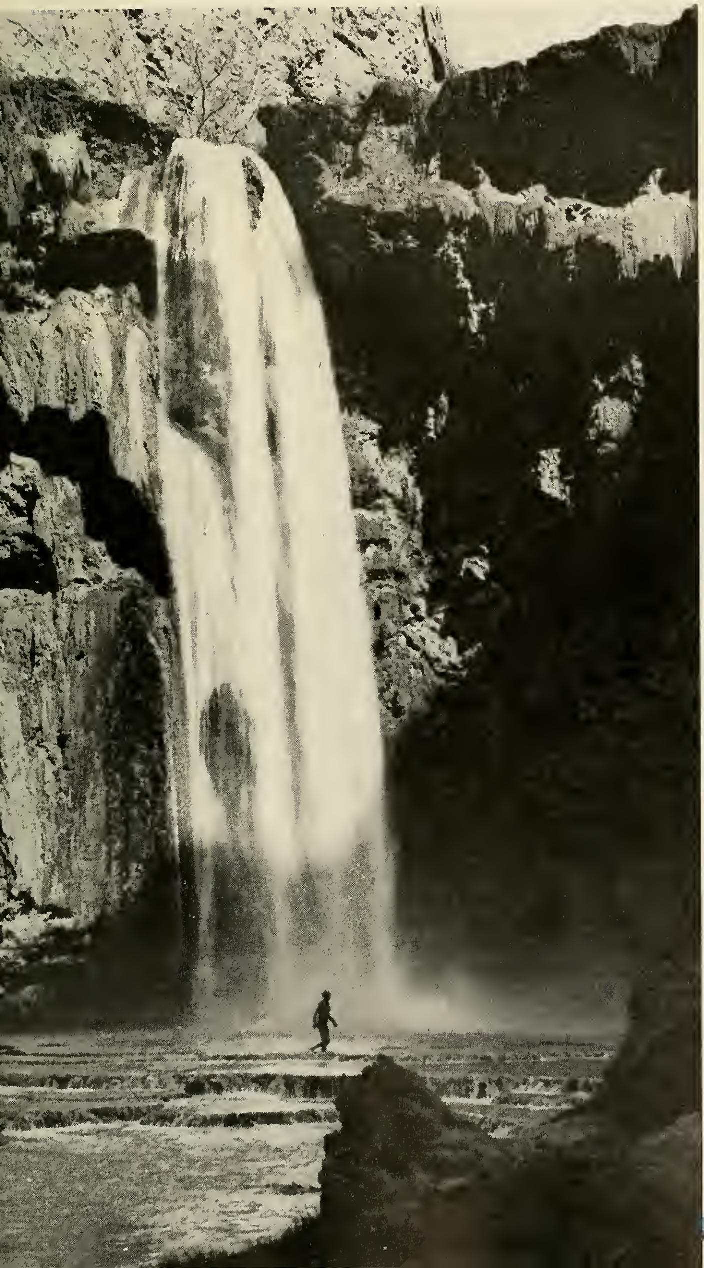
A second type of accretion is that in which the creek water builds low limestone dams across the stream. At the base of each waterfall is a series of these low terraces. To step into one of the pools is to stir up whirlpools of the milky calcium deposited on the stream bottom. The runoff channel of each fall is usually a snow-white, calcium-lined trough through which flows a jewel-like turquoise stream. It is this turquoise hue that has prompted the Indians to refer to themselves as the "People of the Blue Water."

A striking feature of this process of calcification is that, unlike true petrification such as we see in the Petrified Forest, Yellowstone Park, and elsewhere, the deposition in Havasu Creek is not a prehistoric occurrence. It is a living, working procedure going on daily. Here can be seen one of the natural wonders of the world taking form before one's very eyes.

The visitor is not always aware at first glance of the extent of the calcification that has already taken place in the canyon. Great "boulders" that have broken away from prehistoric terraces and hillsides often prove to be masses of calcified material — stone, soil, logs, and branches—solidified into one body and held together by the cementing action of the lime. Between Navajo and Havasu falls is a broad plateau over which the main canyon trail passes. On investigation, this mesa proves to be a massive heap of cemented rubble, riddled with logs and other debris, and situated on the opposite side of the canyon from the present-day stream. Mooney Falls, the most beautiful of the quartette, is set in an amphitheater where the surrounding travertine walls are so honeycombed with detritus that the Park Service, foregoing the usual practice of building a foot trail down the face of the cliff, has dug an approach down through the interior of the soft travertine walls, forming a series of galleries through which a trail descends to the base of the fall.

Here at Mooney Falls is found the most striking example of the third type of accretion. In this instance, the sidewalls surrounding the falls are festooned with hanging stone

James H. Barbour photo



◀ Mooney Falls, showing the travertine terraces in the pool at its foot

Gladys V. Broderson photo

◂ A COOL SPOT for a rest, amid the roar and spray of Havasu Falls

James H. Barbour photo

▴ HAVASUPAI JUNIOR MISSES, who can't understand why visitors from the outside world are so curious

draperies and filagree work, which are as delicate as if created by a skilled seamstress. These travertine festoons, formed by the lime-impregnated spray from the falls, have the appearance of cascading water that has been instantly solidified into the graceful, curving lines assumed by falling spray. Like a prehistoric stream that has left its imprint in an ancient fossil bed, the travertine seems to have captured likenesses of the waterfalls and printed them indelibly on the walls. In some instances, an entire amphitheater is festooned with an overlapping series of these stone canopies which, like the multiple folds of a ballet skirt, give the effect of water fluttering lightly down the face of the cliff.

At Havasu Falls the deposits have accumulated to such an extent that they have formed a stone hood extending fifteen feet from the wall. This hood acts like a giant umbrella, deflecting the water outward from the wall and causing it to tumble down the face of the cliff without wetting the wall behind. Since the stream has shifted its course several times over the centuries, many of these stone canopies are far removed from the present-day stream.

In one respect, the falls in Havasu Canyon are the reverse of ordinary falls, for they are building up where other falls are wearing down. The waters of Havasu Creek build a calcium "lip" at the edge of each fall. This lip grows higher with time until ultimately a barrier is formed, cutting off the flow of the water. The stream is thus forced to seek a new channel. This action has been going on for ages, and as a result each of the existing walls is surrounded with the evidences of old abandoned channels, with the present-day stream tumbling over only a small portion of the enclosing amphitheater.

Instead of climbing up to visit these falls, one views them first from above and then travels downhill to reach them. The northern end of Cataract Canyon is a double gorge, like the Grand Canyon. The first gorge is a mile wide and a half mile deep and cleaves through the white limestone formation. The second gorge is narrower and only 300 to 500 feet deep and winds through the

James H. Barbour photo

◂ A SWINGING BRIDGE spanning Havasu Creek affords a good view of some of the limestone terraces red sandstone strata in the bottom. To the northward, the canyon drops away by the series of falls to join the Colorado River and the Grand Canyon. The Indian village is shut in on all sides by towering cliffs, which can only be scaled in one or two places. The village is situated at a high point in the valley. Before issuing as a spring in the canyon wall, the stream passes through several layers of limestone, where it dissolves and picks up the accumulations of lime that are carried downstream to the falls, where they are precipitated in the form of travertine. So heavy is the lime deposit in the region that one of the large side canyons is appropriately named Carbonate Canyon.

The process of accretion taking place in Havasu Canyon is in general comparable to that which forms the stalactites in Carlsbad Caverns. It is also similar to the process of accretion that takes place about the geysers and hot pools of Yellowstone. There, however, colonies of microorganisms, particularly algae, flourish in the more temperate waters, causing the precipitation of calcium carbonate. In Havasu Canyon, the precipitation is clearly the result of evaporation.

The Havasupai have always been farmers. The main valley is extensively cultivated, and each family has its own plot of ground. In recent years the Indian Service has improved the ancient irrigation system, laid out by the ancestors of the present people, by tapping the stream above the village and installing a canal that serves to irrigate the patches of squashes, beans, and corn—all typical Indian staples—and some melons and ancient peach trees. The latter are said to have been brought into the canyon by an early Mormon fugitive who sought refuge there after the Mountain Meadows Massacre. Much of the tillable land yields Bermuda grass and alfalfa, valuable for the ponies every Indian owns.

The Havasupai's pride in the ownership of horses poses a problem for the Indian Service. The Indians still reckon their wealth in stock, and a family that will be pinched for till-

Continued on page 92

▼ AS IT PLUNGES over Navajo Falls, the stream makes music that is unexpected in a desert, and the damp fragrance of greenery urges the parched traveler to linger in the canyon utopia of the Havasupai

Josef Muench photo

SNAIL INVADERS

Smithsonian photo

Already entrenched and Americanized, this "Fifth Column" of alien mollusks, many of which can carry deadly parasitic diseases, is sounding a clear alert to scientists, farmers, and quarantine officials

By R. Tucker Abbott
Division of Mollusks, United States National Museum

ONE summer day in 1898, many residents of Chicago turned on their kitchen faucets for a cool drink and were startled when out popped hundreds of pea-sized snails. At the city pumping station, millions of these fresh-water snails clogged the wells and screens, and periodically they had to be shoveled out and carted away by the wagon load. Chicago's experience was duplicated in Erie, Pennsylvania, a few years later. Oddly enough, the "faucet snails" were new to most American naturalists, for their known native habitat was, until the late 1870's, limited to northern Europe.

The history of this and similar invasions of the United States by foreign snails warns us of how rapidly an introduced species can spread. In June, 1879, a snail enthusiast by the name of Beauchamp was overjoyed with the discovery at Oswego, New York, of what he first thought was a new species. Further study showed that it was this European snail *Bulimus tentaculatus* Linné, a relative of the one that carries the oriental liver fluke of humans. The initial landing spot will probably never be known, but it was possibly somewhere along the St. Lawrence River in northern New York State. Within 10 years it had mastered the barge canals from Albany to Buffalo, a distance of 300 miles. By 1888, nine years after its American landing, it had broken out into Lake Erie and established itself at Ashtabula, Ohio. From its lake beachheads it moved inland a year later to Sandusky, Ohio, and into the marshes of Toledo, Ohio, by 1911. About 1891, it had extended its range westward into Lake Michigan, striking Black Lake, Holland, Michigan, in 1891, where it was reported as "spreading rapidly." It had reached the Lake View waterworks at Chicago in full force by August, 1898.

In the meanwhile, consolidation was being accomplished in Erie, Pennsylvania, where older residents may still remember the episode of the "faucet snails." A pincer movement was initiated against New England in 1890 with the invasion of Burlington, Vermont. The snails were in the Thousand Islands by 1911, in Cornwall and Toronto, Ontario, in 1913, and in Washington, D. C., by 1927.

Within the last 100 years, approximately 45 immigration visas have been issued by nature to molluscan aliens. A third of these we would like to deport as undesirables. Our greatest concern is not with the foreign slugs and garden snails, though they have cost us millions in crop damage and control measures. It is not even with the threat of the ravenous giant

African snail, which has been recently knocking at our doors at both Atlantic and Pacific coast ports.* Our guard is up for the potential entry of oriental fresh-water snails that carry deadly parasitic diseases of man.

One of the most recent and successful invasions has been made by a small aquatic snail that is capable of carrying the human lung fluke, a parasitic worm of the Orient. Until recently, this so-called Thiarid snail, *Thiara granifera* Lamarck, was limited to the Far East and the western Pacific Islands. Today, it literally paves the sandy bottom of Lithia Spring, Florida, and may be found crawling happily about many a home aquarium throughout the country.

Technically known as paragonimiasis, the disease that may be carried by the Thiarid snail is not to be treated lightly. When the adult worms are attacking the lungs, the symptoms are not unlike tuberculosis or broncho-pneumonia. The disease is insidious at its onset and chronic in its course, with chills, fevers, chest pains, persistent cough, and bloody sputum. When working on the brain, the fluke is responsible for symptoms that have been mistaken for infantile paralysis or meningitis.

Nature was in one of her experimental moods when she evolved this parasite and dictated the complexities of its life cycle. The plump adult worm is about half an inch long and customarily lives encased in pockets of the lungs. The eggs of this lung fluke are coughed up and, upon reaching fresh water, hatch into microscopic, ciliated organisms called miracidia. These tiny swimmers are attracted for some unknown reason to Thiarid snails, into whose flesh they penetrate. Several weeks are spent in the snail, during which time a process of multiplying and developing goes on, which results in the production of another type of tiny swimmer, the cercaria. These must seek out and enter certain species of fresh-water crabs or crayfish in order to continue their life cycle. Within the flesh of the crabs, the larval flukes roll up into pearly-white cysts and await the day when some hapless person or animal eats the crab raw. Once inside the stomach of the mammalian host, the organism is certain to develop to adulthood and migrate to the lung.

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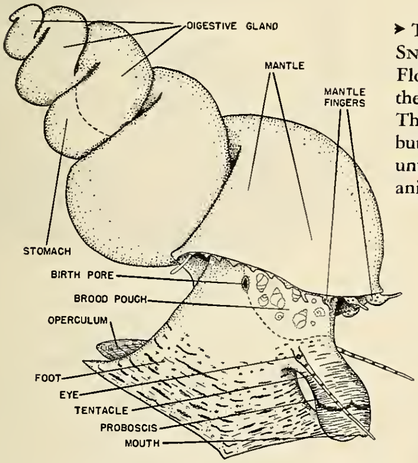
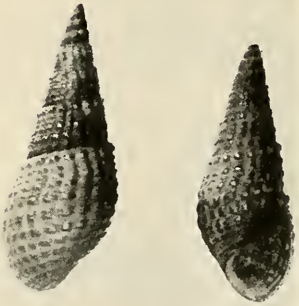
* See "March of the Giant African Snail," NATURAL HISTORY for February, 1949, p. 68.



➤ THE HALF-INCH LONG THIARA SNAILS recently introduced into Florida are potential carriers of the human lung-fluke disease. They resemble our local species but may be recognized by the unusual characteristics of the animal, depicted at left



Smithsonian photo

▲ THE ANIMAL OF THE THIARA SNAIL, with its shell removed to show the peculiar mantle fingers and brood pouch for the young

➤ CONTENTS OF A THIARA BROOD POUCH, showing development from eggs to young snails about to emerge. Note the tiny eyes

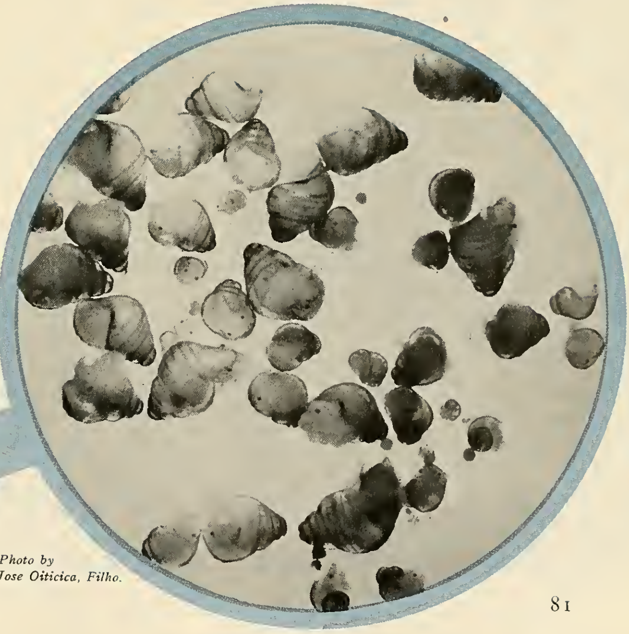
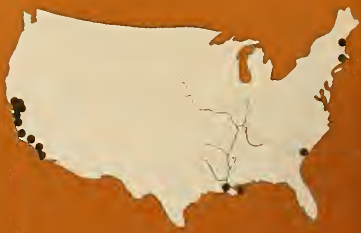
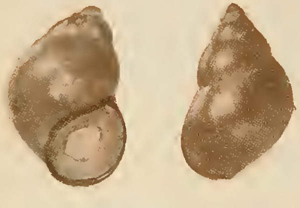


Photo by Jose Oiticica, Filho.

FRENCH EDIBLE SNAIL (*Helix aspersa* Müller)

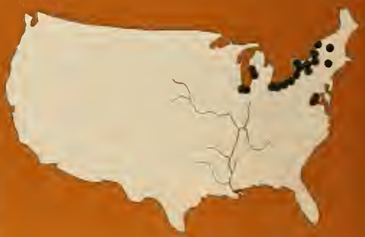
THIS "ESCARGOT" or Brown Garden Snail has become a serious garden pest in California since its first introduction in 1856. These snails are still imported from France and Italy to eastern cities, where they are eaten by many people. Color: light yellowish-brown with dark brown bands and specklings. Size of shell: 1 to 1½ inches. Original home: Western Europe.





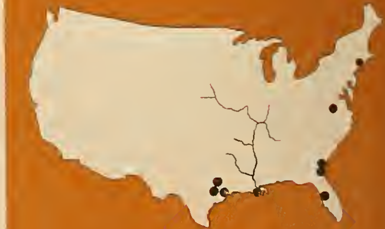
FAUCET SNAIL (*Bulimus tentaculatus* Linné)

SEVENTY YEARS AGO this small fresh-water snail made its American debut. Within a few years it spread over much of the northeastern section of the United States. It is not a human disease carrier but has been responsible for clogging the waterworks of several cities. Color: drab greenish-brown to dark tan. Size of shell: ¼ inch. Original home: Northern Europe



SPANISH EDIBLE SNAIL (*Otala lactea* Müller)

THIS LAND SNAIL is frequently imported from North Africa and Spain for food purposes. It has escaped and established itself in several places in southeastern United States, but it is not a very destructive species. Color: whitish with brown bands and gray specklings. Lip: black-brown. Size of shell: 1 inch. Original home: Mediterranean countries



Smithsonian photos

Fortunately, as an American your chances of catching this disease are extremely remote. The parasitic worm is not in this country as yet; nor are we certain that our species of fresh-water crayfish could serve as intermediate hosts. Nor can we say that many Americans are in the habit of eating raw river crayfish! Lithia Spring may be swarming with Thiarid snails, but it is still a perfectly safe and charming place to swim.

How did this oriental snail find its way to Florida? Back in 1936, a California aquarium dealer had been importing exotic water plants and tropical fish. In one of his shipments from some Pacific or East Indian island, one or two of these snails arrived. At first they were unnoticed, but later they were obvious by virtue of their powers of reproduction. A visiting dealer from Tampa, Florida, was struck by the oddity of these snails. Their elongated, reddish-brown shells are not unattractive, and the snail is able to produce tiny young alive. Within a year or so, this species was being sold as the "Philippine Horn of Plenty." The Tampa dealer occasionally refurbished his tanks with local aquatic plants, and during a foray to Lithia Spring, a wooden collecting tub was cleaned at the edge of the spring. One oriental snail was enough. Within a few years, a budding colony had increased to a density of 400 individuals per square foot.

A study was made of the life history of *Thiara granifera* to determine its capabilities of spreading to other parts of the country. The exact mode of reproduction is still a mystery. To date, we have not found sperm; in fact, we have found no males. Either the snail reproduces without the intervention of the male, or there is a fleeting period of maleness in the early life of the individual. Both types of reproduction (parthenogenesis and protandric hermaphroditism) are known in species of this general type of snail. We do know, however, that developing eggs are stored in a brood-pouch just under the skin on the back of the mother. A molluscan kangeroo! The tiny, red-shelled young may be seen through the skin of its parent, crawling about this protective chamber. The young snails emerge, on the average of one every day, through a small birth pore located on the right side of the mother's body.

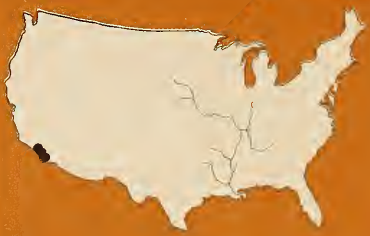
It was discovered that this snail perishes in water temperatures below 70 degrees F. The spring water at Lithia is always about 75 degrees F., but the near-by river into which it flows is well below this temperature and serves as a barrier against further spread of the snail. Birds or man may introduce it to other warm springs, however. In Tampa, the overflow from the commercial tanks supports this species during the warm summer months, but winter chills wipe out these few scouts each year. It is reasonable to expect that this snail will limit its Americanization to a few isolated cliques in remote warm springs of the Southeast.

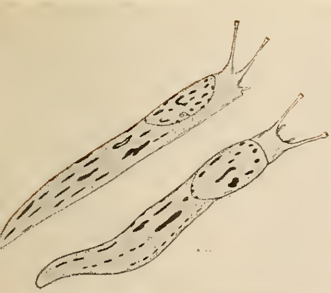
In all, we may breathe a sigh of relief with regard to this latest invader. It does not constitute an immediate menace to our public health. However, other snails, such as *Australorbis,* which would make an attractive aquarium pet, and the Japanese "schisto snail," *Oncomelania,* are far more dangerous. The disease they carry, the blood fluke, is much more serious and is acquired by merely bathing in infected waters or dipping one's hands in the fish bowl. The river systems of the Midwest would probably be ideal colonization grounds for several of these snails. Fortunately, the sanitary habits of Americans reduce the possibility of widespread establishment of the blood fluke, although this disease might be perpetuated by dogs and wild animals which can serve as reservoir hosts.

Four, and possibly more, freshwater introductions have occurred in the United States, although the origins of many remain obscure. Most aquarium fanciers are familiar with the live-bearing Japanese snail (*Viviparus malleatus* Reeve), but few realize that this greenish-brown, golfball-sized mollusk has established itself in several American localities. They were first imported alive from Japan to the Chinese markets of San Francisco in 1891 for food purposes. By 1900, they were firmly entrenched throughout the artesian belt from San José to San Francisco. In the East, they were first discovered by

WHITE GARDEN SNAIL (*Theba pisana* Müller)

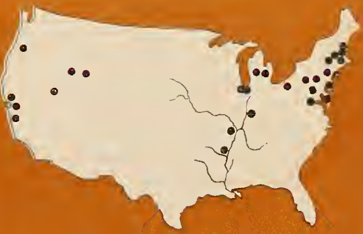
SO FAR, this species is found only in Southern California, where it was first noticed in June, 1914. It multiplies rapidly and becomes a nuisance by partially defoliating trees of citrus fruit, although no serious damage seems to have been done. Color: ivory-white with broken bands of light brown. Size of shell: ½ inch. Original home: Mediterranean countries





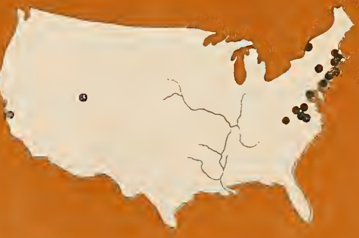
SPOTTED GARDEN SLUG (*Limax maximus* Linné)

THIS IS ONE of the dozen European species of slugs that have established themselves in many parts of the United States. The Spotted Garden Slug does great damage at night to gardens and mushroom beds. During the day, it hides in open cellars and under boards. Color: yellowish-gray with black spots. Length when extended: 3 to 5 inches. Original home: Europe



BANDED WOOD SNAIL (*Cepaea nemoralis* Linné)

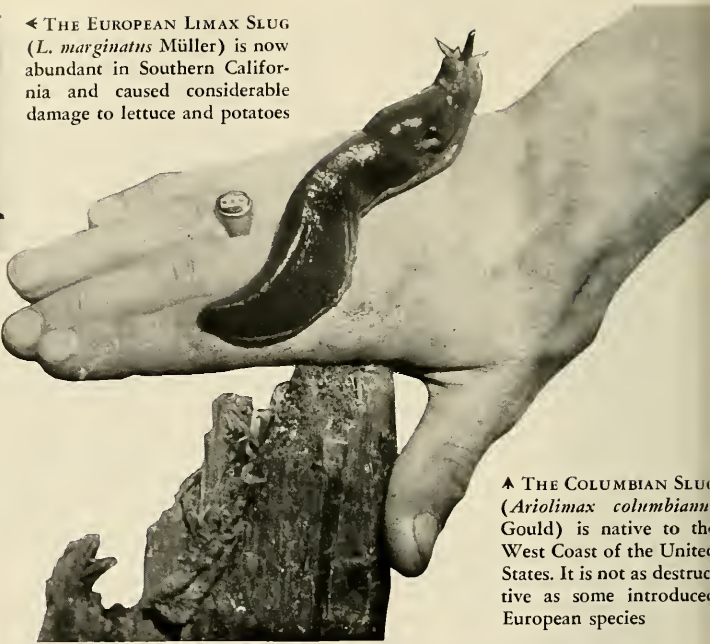
EARLY SETTLERS may possibly have introduced this pretty land snail many years ago. Colonies still thrive in a number of eastern towns. Apparently it does little, if any, damage to gardens. Color: yellow to pinkish-tan with chestnut to black-brown bands. Size of shell: ¾ inch. Original home: Northern Europe



Smithsonian photos

◂ The European Limax Slug (*L. marginatus* Müller) is now abundant in Southern California and caused considerable damage to lettuce and potatoes

Courtesy of H. A. Pilsbry



▴ The Columbian Slu (*Ariolimax columbianu* Gould) is native to th West Coast of the Unite States. It is not as destructive as some introduce European species

Smithsonian photo

Dr. William J. Clench, Harvard's mollusk expert, in April of 1914, in the Muddy River of Boston's Fenway. I have collected many beautiful specimens there as late as 1942. A colony may still survive in Lake Quinsigamond, near Worcester, Massachusetts, where it was first reported in September, 1917. This "escape" has also been found in Fairmount Park, Philadelphia (1925), St. Petersburg, Florida, and near Niagara Falls, N. Y. (1942).

"Among those also present" is a fresh-water corbicula clam from Japan, which is doing well in the Columbia River, Washington, and a small valvata snail, which is now widespread throughout the Great Lakes region. A small, left-handed pond snail, *Physa acuta* Draparnaud, has occasionally journeyed from Europe and temporarily set up egg-laying in eastern cities.

Even some of our common seashells are not native to the United States. Every visitor to the rockbound coast of New England who has observed the denizens of the tidepools is familiar with the common periwinkle, *Littorina littorea* Linné. Its "Plymouth Rock" is unknown, although it was first found at Pictou, Nova Scotia, in 1840. From Nova Scotia it spread rapidly southward, its pelagic early stages being carried in the plankton by the Labrador Current. By 1892, it had reached its southern limits at Atlantic City, New Jersey. In exchange for this European student, we returned (accidentally, of course) to England an American citizen, the dreaded oyster drill, which annually kills a million dollars worth of oysters. This was hardly sporting on our part, but while we were making apologies, an even larger and more destructive drill, *Ocinebra japonica* Dunker, was brought in from Japan and has established itself in several bays of Puget Sound. Such is the price to pay when introducing "bigger and better" oysters from foreign lands. Pests always come with them.

Land snails, however, stand foremost as successful immigrants, and Californians who take pride in their beautiful gardens can surely wax eloquent on the European brown garden snail, *Helix aspersa* Müller. A great deal of expense, both private and public, has been incurred in the battle against this vegetarian. This species is probably the most widely traveled of his clan, since it is one of the elite "escargots" or edible snails of France. Wherever the "fleur-de-lis" has been unfurled, this species has been among the wit-

Courtesy of H. A. Pilsbry

▸ The White Garden Snail (*Theba pisana* Müller) is from the Mediterranean countries. It has caused partial defoliation on California citrus trees and other plants

nesses. *Helix aspersa* first reached the United States at Portland, Maine, in 1839 and was last seen there in 1936. Its most successful landing was made in 1856, when it was introduced for food purposes at San José, California. It arrived in New Orleans from Spain and in Massachusetts from Ireland.

Several other land snails have become permanent residents, some quite a nuisance, such as the white garden snail, *Theba pisana* Müller, which partially defoliates citrus trees. The distribution of the various species follows the temperature and humidity gradients that best suit them. The Spanish edible snail, *Otala lactea* Müller, which is accustomed to the warm, dry areas of the Mediterranean, has had ample opportunity to establish itself from Montreal south, but it has gained a foothold only in such southerly localities as Cockspur Island (Georgia), Houston (Texas), St. Petersburg (Florida), and Los Angeles. Should the giant African snail make its entry into the United States, it is my opinion, which may differ from that of other malacologists, that the southern third of Florida is the only suitable area for its survival for any great length of time. Recent accounts of the invasion possibilities of this giant border on the hysterical, although I do not wish to minimize the importance of keeping a watchful eye on snail invaders.

The unattractive slugs of Europe have done well for themselves in America. Eleven or more species are now firmly entrenched on our soil, and a few of them are found in nearly every state in the Union. Public enemy numbers 1, 2, and 3 are the spotted garden slug, *Limax maximus* Linné, the true garden slug, *Deroceras*, and the tawny garden slug, *Limax flavus* Linné. These European colonists retain their gregarious habits and in certain local areas are able to build up their numbers to very destructive proportions within a relatively short time. The American species, on the other hand, are less socialized and are, for the most part, solitary in habit and much less destructive.

Once here, foreign snails have many opportunities for further dispersal. Inspection of the bases of potted palms and other plants in hotel lobbies will often reveal such tiny aliens as *Subulina* and *Lamellaxis*. Transplantings, market crops, lumber that has been stored in seaboard cities, water cress grown in the south and shipped north each season—these and dozens of other transportation activities help spread molluscan pests.

Despite the iron-clad laws now in existence to keep out disease-carrying snails and the fine-toothed combing given agricultural shipments from abroad, it is perfectly natural that a few molluscan Dillingers are going to dodge the long arm of the quarantine laws. Our best protection is to continue our vigilance at our borders, which at present is as efficient as is humanly possible, step up our research on snails and their control, and familiarize agriculturists and aquarium dealers with the snail problem through the medium of popular articles.

Saving Your Garden From Snails

DESTROY 'EM!

The vast majority of species of snails stay in the woods and mind their own business, but not infrequently a row of garden lettuce or celery falls prey to hungry immigrant snails or slugs. One of the most successful poisoned baits consists of one ounce of metaldehyde to three pounds of wheat bran or "dry cereal," slightly moistened and scattered over the infested area. If small children or animals have access to your garden, scatter it thinly and not in large lumps or balls, since metaldehyde is mildly poisonous to warm-blooded animals.

Eliminate the snail's favorite haunts such as piles of old boards, bricks and stones, and dense, low-growing vegetation. Keep spaces beneath porches dry, and seal up chinks in basement walls. Hand-picking at night with a flashlight also helps.

Write to the Superintendent of Documents, Washington 25, D. C., for "Land Slugs and Snails and Their Control," Farmers' Bulletin No. 1895, by W. H. White and A. C. Davis. Price, five cents.

EAT 'EM!

The thought of eating snails is enough to break the courage of the hungriest American; but in Europe, "escargots" are eaten by the million each year, and in France snails are a national delicacy. Any snail is safe to eat if fresh and cooked. The secret of success with snails is in their preparation for the table.

First the snails are boiled in the shell for five minutes, after which they are removed, cleaned of the softer parts, and then reboiled for two hours. Leave whole or mince. Make a paste of butter, a considerable quantity of good olive oil, chopped parsley to taste, and a small quantity of minced eschalot or small onions. Thoroughly clean the empty shells and then stuff with snail meat, closing the aperture with a plug of the butter paste. In this condition they can be kept for some time in the refrigerator until ready for cooking. Simply heat them for about ten minutes over a hot fire, which literally broils the meat in the butter paste. Serve six to eight shells to a person; garnish plate with greens or salted crackers. Believe it or not, these snails taste very much like broiled oysters.

Other intriguing recipes, methods of farming snails, preparation for market, and other interesting facts are found in "Edible Snails" by E. W. Rust, Department of Agriculture Yearbook for 1914, Separate No. 653.

THE KIWI–

New Zealand's Flightless Oddity

Nature's unbelievable Believe-It-Or-Not, the kiwi—most unbirdlike of living birds and a twentieth-century anachronism. Even scientists insisted, "There ain't no such creature"—only to find it more fantastic than they had imagined

By Vion *and* Bernard Schram

AT a crucial point in the Pacific war, supplies for the New Zealand troops stationed on New Caledonia failed to arrive on schedule. Familiar with military mix-ups, the supply sergeant began a canvass of other allied depots.

He inquired at the American base, "Are the Kiwi supplies here?"

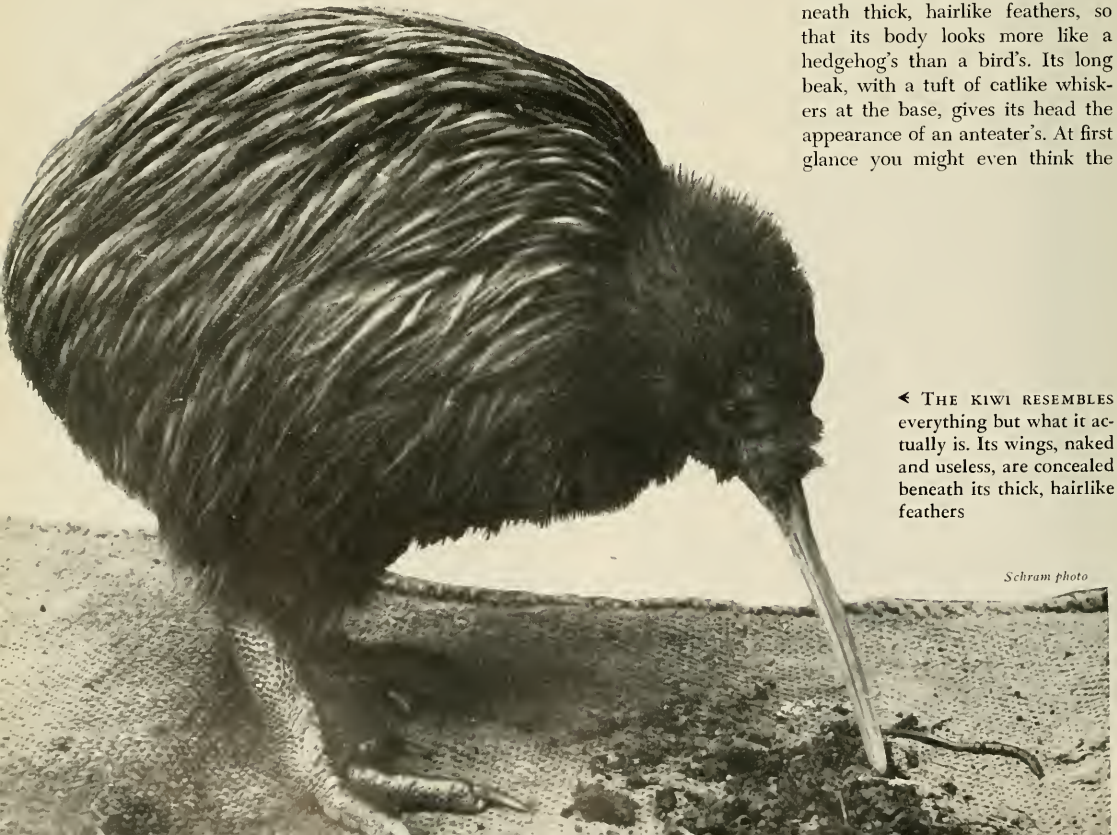
The bewildered Yank in charge scratched his head and asked, "*Whose* supplies?"

Then, after a moment's thought, enlightenment dawned.

"Oh, you mean those boxes with the picture of a long-nosed, flat-bottomed duck marked K-one-W-one?"

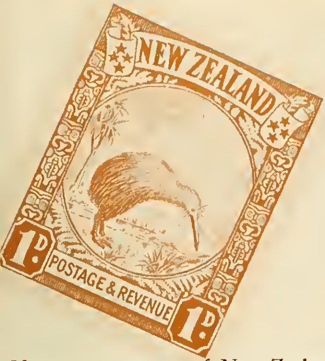
The "flat-bottomed duck marked K-one-W-one" was none other than New Zealand's national emblem, a creature almost as out-of-date in modern times as a dinosaur, and the exclusive pride and joy of New Zealand, the only place in the world where kiwis are found.

Even ornithologists label the kiwi "the queerest and most unbirdlike of living birds." It resembles almost everything but what it actually is. Unable to fly, the kiwi's naked and useless wings are concealed beneath thick, hairlike feathers, so that its body looks more like a hedgehog's than a bird's. Its long beak, with a tuft of catlike whiskers at the base, gives its head the appearance of an anteater's. At first glance you might even think the



◂ The kiwi resembles everything but what it actually is. Its wings, naked and useless, are concealed beneath its thick, hairlike feathers

Schram photo



NATIONAL EMBLEM of New Zealand, e awkward kiwi graces 'a Government amp. New Zealand is the only place in e world where the bird is found

National Publicity Studios, Wellington

▲ **TWO KIWIS**: a New Zealand serviceman and his namesake. Somehow the country's armed forces were named "Kiwis," and the label stuck. Only airforcemen resented being named after a flightless bird

skin was a mammal's rather than a bird's. It is tough and leathery enough to be made into gloves and moccasins.

Very few foreigners and not so very many New Zealanders have seen a kiwi. Because of its timid love of darkness and its habit of digging rabbit-style burrows for daylight nesting, the kiwi was called "the hidden bird" by the Maoris, who thought it was under the special protection of Tane, god of the forest. However, this did not prevent these Polynesian hunters from tracking down kiwis for food and for their feathers, from which cloaks were made. Some of these early Maori cloaks, woven from native flax and kiwi feathers, are still in good condition though they were made as long as 200 years ago—a tribute to the durability of the kiwi's hairlike plumage.

The Maoris named the bird kiwi in imitation of its cry—a shrill whistle that sounds like *keeeee-wheee.*

Before the advent of the white man in New Zealand, kiwis abounded, despite large numbers slain by the Maoris. Fortunately, from a kiwi's point of view, New Zealand had no native mammals or reptiles to prey upon it, so that it was as safe from attack on the ground as in the air. Thus it was able to survive as a curious, earthbound bird, with vestigal wings measuring hardly two inches in length.

The downfall of the kiwi resulted from the nostalgia of English pioneers who longed for their familiar sports. Soon after establishing themselves in New Zealand, the settlers introduced all manner of foreign birds and animals to provide themselves with good hunting quarry. But they made one grave mistake: they loosed English rabbits and hares upon the countryside. Living up to their reputation for fecundity, the rodents soon multiplied until they became pests, threatening farm crops and ruining gardens. So the settlers promptly brought in stoats and ferrets to control them. This step also proved a boomerang.

The weasels quickly discovered that the native New Zealand birds, made unwary by centuries of life without ground enemies, were easier prey than the rabbits. The kiwi, which had the added disadvantage of being unable to fly, was almost entirely at the mercy of the imported killers. In short order, the kiwis' numbers were so reduced that New Zealand bird lovers feared they were doomed to extinction.

Yet another menace came from an unexpected direction. In their enthusiasm for sports, the New Zealand pioneers introduced American and European trout into their streams and lakes. In their avid experimentation in quest of artificial flies with trout appeal, they decided, with the inexplicable logic of the fisherman, that the drab brown and gray feathers of the kiwi made lures irresistible to the fish. Consequently, they scoured the countryside with dogs and guns, slaughtering hundreds of kiwis for their plumage.

As a result of these onslaughts

from all directions, kiwis became a curiosity instead of a commonplace bird in New Zealand.

By 1908, the kiwi had become so rare that a law was passed making it illegal for anyone to "take or kill" a kiwi without special government authorization. The law was weak and subject to widespread violation, so that in 1921 a new act was passed, which proclaimed the kiwi an "absolutely protected bird" and made it illegal for anyone to possess stuffed specimens, feathers, eggs, or Maori handicraft objects made with kiwi feathers, without permission from the Minister of Internal Affairs. The law also prohibited, on penalty of a $100 fine, the making of trout flies from kiwi feathers. A ban on exportation of the birds has been in effect since the 1908 law.

These laws, rigidly enforced by New Zealand's wildlife rangers, have helped to check the decline of the kiwi population, although the stoats and ferrets continue their raids. Conservation enforcement is difficult in any land. Dogs destroy large numbers, and vigilance for the welfare of the kiwi will continue to be necessary.

From the initial word of its existence brought to Europe by early nineteenth century explorers, the kiwi has been the object of curiosity and incredulity. Zoologists expressed frank disbelief in the existence of this "ball of fur on two sticks." Even when Captain Barclay of the ship "Providence" brought a kiwi skin back to England in 1812, scientists imitated the farmer who, seeing a giraffe for the first time, stoutly maintained, "There ain't no such animal." Later, when a live kiwi was presented to the London Zoological Garden, they were forced to admit that the fantastic bird actually existed.

Kiwis then became the rage among bird fanciers. Lord Rothschild collected a number of specimens for his private aviary. The Emperor of Austria and Hungary secured a pair for his personal zoo. Collectors and zoological gardens all over the world vied in procuring the weird birds.

All had the same experience. The nocturnal birds lived for only a short time in captivity, and none produced young, even though one obliging kiwi in London sat on an infertile egg for 114 days before admitting defeat.

But the kiwi egg proved as great a curiosity as the ungainly bird itself. One species of kiwi weighs only five or six pounds at full maturity yet lays an egg weighing a pound or more—almost a quarter the size of the bird itself. So dis-

Photos courtesy New Zealand Legation

▲ Kiwis burrowing for worms. By the age of three months, the baby kiwi consumes one and a half pounds of worms a day—or 800 of them

◀ The elongated beak comprises nearly a third of the kiwi's total length. So acute is the bird's sense of smell that it can locate worms underground before driving its bill into the earth proportionately large is the egg that just before it is laid, the overladen hen staggers under the weight like a drunken sailor in a gale. Even the ostrich, which may weigh as much as 250 pounds, lays eggs that are only slightly larger; and the domestic turkey, a much bigger fowl, lays an egg less than a third the size of the kiwi's.

It was only three years ago that the first kiwi chick was hatched in captivity, enabling scientists to report that the kiwi male is easily the most henpecked husband in the world.

The credit for this achievement goes to F. D. Robson, Curator of the Hawkes Bay Acclimatization Society's game farm near Napier, New Zealand. An expert in raising pheasants and trout for release in the Hawkes Bay area, Robson acquired—illegally, it may be added—his first kiwi some seventeen years ago. It was a fully grown, five-year-old cock that had been captured by pig hunters, who kept it secretly until it escaped. The frightened fugitive bird was found huddled in a Napier factory coal bin and was turned over to Robson. Curious to learn the habits of the rare creature, Robson ignored the law requiring him to report possession of the bird to the wildlife officials.

Robson kept his kiwi for six years, until he was fortunate enough to acquire a badly injured one-month-old chick that had been caught in a bush fire. He carefully nursed the chick, a hen, for five years until she reached maturity. She then started on an egg-laying spree that refuted all authorities who had previously claimed the kiwi could lay but one of its monumental eggs per year. Within a four-month period, Robson's hen laid four eggs — all of which, however, proved to be infertile.

By this time, word of his under-the-counter kiwis reached the ears of the authorities. Considerable controversy arose, with the influential Hawkes Bay Acclimatization Society taking Robson's part. At length, a special cabinet meeting handed down a decision that Robson could keep his pets in order to observe their breeding habits, on condition that he provide the Department of Internal Affairs with semiannual reports on his findings.

On September 19, 1945, Robson announced an event that held as much interest for New Zealanders as the Dionne quintuplets for the Canadians: the first kiwi was hatched in captivity. Unlike Papa Dionne, whose role had been all but ignored, Papa Kiwi came in for the lion's share of the credit.

For weeks, New Zealand newspapers printed almost daily reports on the progress of the setting, and editorials featured the brow-beaten male kiwi as the most notable victim of female emancipation.

As Robson describes the situation, "After Mama Kiwi laid the huge egg, she lost all interest. It was Papa Kiwi who made the nest and sat on the egg for 80 days until it was hatched. Sometimes he wouldn't leave the nest for a week, going without food, and at the end of the ordeal, he had lost two pounds in weight. He didn't look much bigger than the chick when it was hatched.

"While he was on the egg, he was so maternal he'd attack anyone who approached him, and the only time the hen came close was just before the egg was hatched. One day she came to the box in which the male was nesting and rapped on the outside with her beak. He replied by tapping on the box from inside. They must have been using some kind of Morse code, because she went away satisfied and took no further notice of the incubation."

Insult was added to injury for male vanity when the kiwi hen laid a second egg only 26 days after the first, just when the poor male had gotten well settled on it. As a consequence, the harassed husband had to extend his vigil to 100 days, at the end of which not one but two chicks had been hatched. Last season he had an even worse ordeal. Five eggs were laid over a period of six months, and the male bird sat continuously for 185 days.

News of the new arrivals traveled round the world among bird circles. In America the tale of the kiwi chicks and the birds' gigantic eggs caught the eye of an enterprising poultry farmer. Without delay he wrote to Robson requesting all details, with an eye to crossing kiwis with his hens to produce larger eggs.

"When he heard that kiwis only lay a couple of eggs a year, he lost interest," Robson reports.

Since then Robson has been assailed with bids for the kiwis, which are really wards of the state in his custody. One American bird fancier has offered $1200 for a fertile kiwi egg and promised to arrange for its delivery to the States by air. More recently, an American tourist, a little the worse for a farewell shipboard party, landed in Auckland and demanded to know, "Where can I buy one of these kiwi birds?" Undismayed at the news that kiwis were not for sale anywhere, he lurched down the street, proclaiming, "I'd give $50 for one of these d———d birds."

All such proposals, including a patriotic suggestion to present a pair of kiwis to Winston Churchill in appreciation for his war services, have been politely rejected.

Wildlife officials point out, "The kiwi is not a bird that adapts itself to exhibition. It is a night bird, accustomed to sleeping during the daytime, just when people would want to see it. Moreover, its food demands are such that it does not appear to thrive on a strange diet. Therefore, no kiwis are being released for zoos."

In reality, the Wellington Zoo has two kiwis on a basis of dubious legality. Residents of the zoo for many years, the kiwis roam the bush adjacent to the menagerie area. They are caught on rare occasions for display to important visitors and were penned for some months for the benefit of American troops stationed in New Zealand. When queried about the kiwis, the curator innocently lifts his eyebrows and protests, "We have no kiwis in captivity. There may be wild ones on the grounds, but we can't be responsible for them."

However, the kiwis' presence is all too well known to the zoo gardener. The birds have taken a fancy to his rose garden, in the beds of which they probe nightly in quest of worms. Lately, they have developed an unaccountable taste for rosebush shoots and, much to the gardener's dismay, have completely stripped the plot of young plants.

Robson is a whole-hearted sympathizer in regard to the kiwis' "food demands." The baby kiwis at the game farm are born weighing only six to ten ounces. During the first four days of their life, they are too weak to support themselves on their own legs, and Papa Kiwi, who by this time has had enough trouble with them, doesn't bother to feed them. On the sixth day, the chicks stalk out on their own and start boring into the ground with their beaks in search of worms. For the first two weeks of their life, they lose weight. Then they commence to gain, and at the end of three months they each consume one and a half pounds of worms a day.

The daily worm diet for the chicks, with slightly less for the adults, keeps Robson hard at work. Although he stumbled across the expedient of "planting worms" by burying bits of meat from which maggots hatch, he still spends many hours engaged in worm digging.

"Do you know how many worms it takes to make a pound and a half?" he asks ruefully. "It takes 800."

His kiwi brood now numbers six —the original pair, three of their offspring, and "Pegleg Pete."

"Pegleg Pete" is a recent acquisition. Some months ago, he was caught in a possum trap, which broke his leg. The trapper turned the injured kiwi over to the conservator of game, who was forced to amputate the broken leg in order to save the bird's life. Then it was sent to Robson.

Robson has ingeniously devised a pegleg for the bird by whittling a hollow joint of bamboo to fit the stump and making it fast with a piece of rubber tubing. Today "Pete" hops around so agilely on his pegleg that he frequently eludes Robson when the curator seeks to catch him in the large enclosure housing the kiwis. Consequently, Robson sometimes has to resort to trickery. Sighting the bird, Robson will make a scratching noise on the ground to startle him. When the myopic kiwi charges blindly forward, Robson jumps to one side. The bird butts into the wire fence, and the curator captures him before he recovers his balance.

Robson has his own theory about why kiwis lost the power of flight. He bases it on the fact that the kiwi has very poor eyesight—with a range of vision limited to about two feet in daylight and six feet at night. He states that a bird so blind could never fly in the forest without killing itself.

Despite its groundling status, the kiwi is a well-qualified sprinter. It easily outdistances an unmounted man and can hold its own against dogs. Most kiwis that are captured by dogs are surprised during daylight when they are asleep in their burrows.

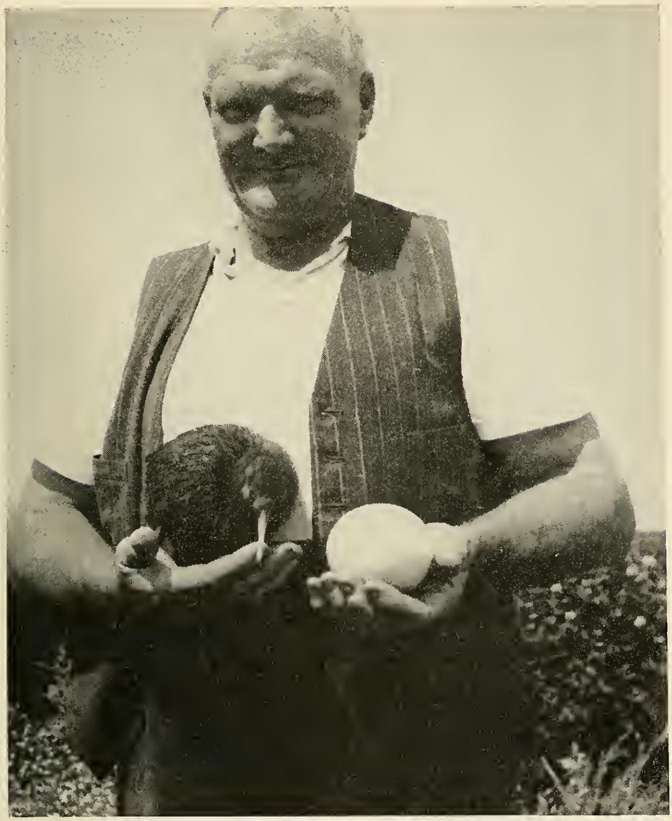
Although a subject for zoological study for more than a century, the kiwi has been seen in a live state by relatively few ornithologists. Those who have seen the bird at close quarters find the kiwi so ludicrous in appearance that they are moved to attempts at whimsy, even in scientific writings.

The noted New Zealand naturalists F. W. Hutton and James Drummond felt called upon to assert: "Not a bone in its frame or a muscle on its ungainly body, and hardly a feather of its hair-like plumage has escaped minute and elaborate description. Its innermost private life has been invaded; and its habits, its clumsy gait, its wretchedly defenseless condition, its family failings, its deformities and malformations have been made public."

Like a Walt Disney character come to life, the kiwi literally sniffs its way through life, depending on its keen sense of smell to guide it, in compensation for its pitifully weak eyes. To facilitate this, the nostrils are in the very tip of the elongated beak, which comprises nearly one-third of the bird's total length. With audible snorts, the kiwi wobbles ungracefully along, its beak inquisitively probing the ground at each step. Its sense of smell is so acute that it literally smells worms underground before driving its bill into the earth.

▼ THE MOST HENPECKED HUSBAND in the world: Papa Kiwi incubating an egg. After the egg is laid, the female loses interest, and the male is saddled with all responsibility until the hatching

Courtesy New Zealand Legation



▲ THE GIGANTIC EGG is out of all proportion to the kiwi—almost a quarter the size of the bird itself

Schram photos

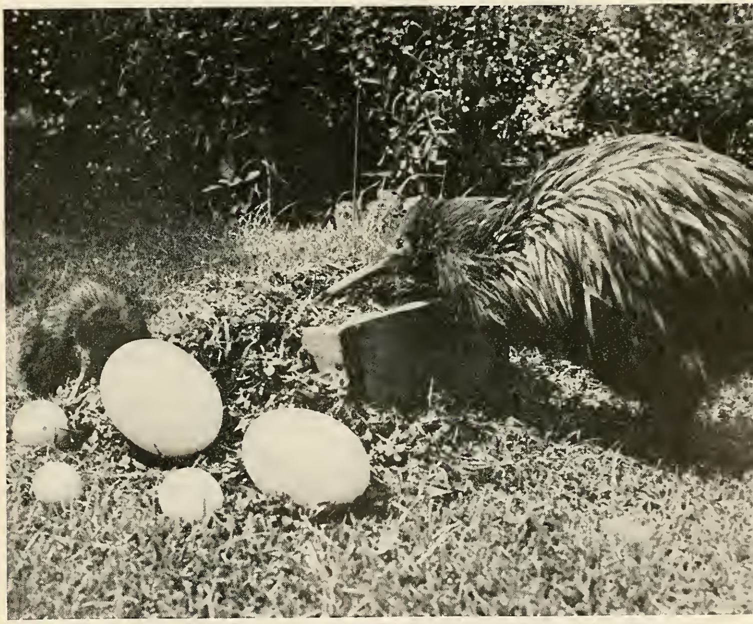
The kiwi runs like a novice tightrope walker, placing each foot exactly before the other in a straight line, while its tailless rear sways wildly from side to side in a feathery burlesque of the cancan.

Had it not been for the war, popular interest in the kiwi would probably have remained confined to New Zealand. But before the war ended, every newspaper reader and serviceman knew the gallant New Zealand fighting forces as Kiwis.

There are numerous theories as to how the name Kiwi came to be generally applied to the New Zealanders fighting all over the world. One story says that the term was first applied to them by their Australian neighbors. Another attributes it to the popularity of an English shoe polish using the kiwi as a trademark and brand name. This version has it that Arab servants employed in polishing New Zealand officers' shoes in North Africa began calling them all "Mr. Kiwi."

Regardless of origin, the term quickly gained acceptance and was applied to all New Zealand forces on land, sea, and in the air—much to the disgust of airforcemen, who resented being named after a flightless bird. Soon American and English airmen were calling their own ground crews Kiwis because they did not fly.

When the Pacific battle started, the term was so popular that the New Zealand Third Division on duty against Japan boasted the kiwi as an official insigne. They published a service newspaper entitled "The Kiwi News" and received all their mail and supplies with the kiwi stenciled on the containers. German propaganda leaflets dropped for New Zealand troops



▼ STUDY IN CONTRASTS: hen's eggs and kiwi's. Even the domestic turkey, a much bigger fowl, lays an egg less than a third the size of the kiwi's

in Africa addressed them familiarly as Kiwis and featured illustrations of the national bird. Military cartoonists habitually used the kiwi to symbolize New Zealand forces.

When New Zealand troops retreated from Greece after a valiant but futile holding operation, they sadly remarked, "We kiwis can't fly, but, by God, we can run."

Today the kiwi is prominent in every aspect of New Zealand life. Its awkward figure graces stamps, bank notes, and coins. Business firms using its name range from the Kiwi Dental Repairs Company to the Kiwi Cake Kitchen. It has been adopted as the distinguishing mark of the New Zealand Manufacturers Federation and appears on all products made by the organization's members.

At least one noteworthy New Zealander, however, takes issue with all this kiwi-consciousness. He is Arthur P. Harper, President of the Forest and Bird Protection Society of New Zealand.

"America has her eagle that stands for freedom," he says. "Britain has the bulldog to signify tenacity. We've adopted a beastly bird that isn't even good to eat."

Harper, an eighty-four-year-old New Zealand pioneer, ought to know. Credited with opening up large regions of New Zealand through his exploration in the last century, Harper has spent most of his life in the native bush along with the kiwis. In the old days, he ate kiwi on many occasions.

"It tastes terrible," he reports. "Like an old piece of pork boiled in second-hand coffee."

CANYON UTOPIA *Continued from page 79*

able land will devote several acres to raising the feed needed for the ponies. Bert Jones, our twenty-one-year-old guide, boasted that he and his father owned a couple of hundred head of stock, most of which ran wild on the mesa above and were rounded up only when tourist demands made additional stock necessary.

Visitors, who have been coming to Havasu in increasing numbers in the last decade, provide a modest revenue for the Indians. These visitors require pack animals, saddle ponies, and guide service, all of which mean a small but steady income for the Indians. Since visitors are few as yet, the proceeds from this source are necessarily small, but they are a welcome addition to the villagers' meager income and explain their friendliness to outsiders. The Indians round out their income by taking occasional jobs on the plateau above. Most of the young men do seasonal chores for the National Park Service. They also engage in a little horse trading, do work on the roads, or fill a variety of simple jobs that earn an honest dollar. However, Havasu Canyon is home to them, and they always return in time for the planting and later for the harvesting.

Despite their sometimes pinched conditions, the Havasupai are a happy people. Their needs are few and simple. They have their own local law enforcement machinery, a school for their children, and a government agent who devotes his whole energy to supervising their welfare. Besides the white man's law as embodied in the subagent, the Havasupai have their own representation in the form of a local council. This body consists of seven members, including three hereditary chiefs who serve for life and four others members elected annually by popular vote. The council handles the minor affairs of the tribe and has jurisdiction over certain phases of the Indians' life – although every major proposal must have the approval of the Superintendent of the reservation.

The only local vice is gambling, and the whole adult population indulges. A closely-knit people like the Havasupai have little home life as it is understood by other races. Their pleasures are derived from gathering with the other members of the community. Around two every afternoon they begin to assemble at a clump of cottonwoods near the stream. Soon the whole village is there, squatting cross-legged in the shade. Here on blankets and sheepskins laid out on the ground, they begin the gambling, men and women smoking their hand-rolled cigarettes and noisily making their bets. A man may leave off work during the heat of the afternoon and sit in on a session of cards, returning to his fields when the heat has subsided.

They play a complicated game, in groups of seven, with each player holding ten cards. Though they gamble for small stakes, they play with great enthusiasm and good humor and gather up their winnings with the eagerness of laughing children scooping up marbles. The winnings go into groceries and clothing and jewelry and trappings for their horses. The village has a buying co-operative, and once a month the agent goes outside to Williams or Flagstaff and brings back the supplies. The people have a spirit of friendly co-operation, though they do not share their winnings.

Besides the daily gambling, the Havasupai have few diversions. They take part in the annual Powwow at Flagstaff, in which they always enter a few riders and generally make out well enough. They also have two or three ceremonial dances. These dances are not necessarily religious in nature. One festival celebrates the fruit harvest and is purely a social affair. The Havasupai are not outwardly pious, although like all Indians they are inherently religious and have their own version of the stories of the Flood and the Creation.

The Supai are not a picturesque people, as Indians go. They have few tribal traditions, few legends, and no native costume. The women dress in shapeless Mother Hubbards and generally go barefoot. The men, because of their contact with visitors, dress more picturesquely, wearing the traditional cowboy riding outfit of broad-brimmed Stetson, blue jeans, colorful shirt, and gay neckerchief. They belie the Indians' reputation for stolid silence by being a friendly and even talkative people. They are quick to smile and laugh, and greet strangers cordially. Even the women show a friendly attitude toward whites—something rare in Indian behavior.

Visitors are still a novelty to the simple villagers, who cannot understand what makes whites so inordinately curious. The old men question visitors eagerly concerning the outside world. The women, like women the world over, sit and gossip with the neighbors. Squatting on the bare ground, they mold the tortilla-like loaf of bread which is their chief item of food and which is fried over an open fire out-of-doors—where all cooking is done.

The pastoral seclusion of this desert utopia is in little danger of being interrupted by an immediate foreseeable circumstance. Since Havasu Canyon lies within a reservation, which in turn is embraced within a national park, the little settlement would appear to be doubly secure from the encroachments of all save those hardy adventurers who enjoy roughing it. While the village has sleeping accommodations for half a dozen, it has no provisions for serving meals. At the present time, visitors must bring their own food and bedding and be literally self-sustaining. Because of the limited accommodations, prospective visitors who prefer to sleep under a roof should write to the tourist-agent at Supai, Arizona, via Grand Canyon, in order to assure themselves of reservations.

Havasu Canyon is an outstanding scenic area. Below the village is the primitive region of rugged grandeur with its series of enchanting waterfalls, which are among the most beautiful on this continent. Only their isolated location has kept them from becoming a mecca for visitors. But the traveling public is catching on, and Havasu Canyon is due for a tourist boom. Faced with this happy prospect and with the innovations the Indian Service has in mind, the Supai of Havasu Canyon have little need to worry about the future of their canyon home. Under the watchful eye of the Indian and National Park services, they are likely to enjoy their present fortunate status—which is a combination of Eden, Utopia, and the happy hunting grounds—until the day the Supai Gods tumble from the canyon rim and crumble to dust in the sparkling depths of the Blue Water.

THOSE BAROTSE!

Continued from page 61

through a stately mopane forest and saw lion tracks, and we knew the lions would not be there unless there were game. Then we came upon buffalo spoor and were confident that our food troubles soon would end.

By late afternoon we had passed no village, seen no signs of man, until we reached, before sundown, a large boma—a clearing surrounded by a reed fence. Surely this must be M'Lumba's, the large village we had been told we would find across the border. Surely we must, at last, be in Portuguese territory and no more than a few days' walk from Tete. In so large a village, too, we should be able to trade for grain to feed our hungry carriers.

A scowling, unfriendly headboy and his two wives greeted us. It was M'Lumba, and he and his women brought a fowl and a few eggs, for which I haggled while the men went hunting. A buffalo in camp would change the unfriendly atmosphere, so I turned away from the villagers and went about the business of making camp, although conscious that M'Lumba and his women hovered like vultures, waiting for further trading, and I knew that the problem of that evening's meal was not yet settled.

The hunters came in with a small waterbuck cow, which was no more than a tantalizing suggestion to 60 hungry boys. We brought out a few yards of calico, but M'Lumba saw our predicament and drove a hard bargain for very little grain. There were low mutters about the lack of food, the weight of the loads, the distance to Tete.

When it was dark, I picked up our last half sack of sugar, hoping that might tempt the surly M'Lumba.

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We had to keep the M'Curry Curry in a good humor and get the children through to the safety of the camp.

Shilling, brother of the Mudalla, stepped up and took the sugar sack. "You cannot sell that, Inkos," he said indignantly. "We are black boys. If we die it does not matter. You and the picannins must get through to Tete, and you must not sell your food. We can get along."

Those Barotse!

The campfire crackled, and it should have been a peaceful night, but it was not. M'Lumba said it was far to Chioco, the next village, and that there was no water on the way, which meant that there would be little game, if any.

Pocket, one of the M'Curry Curry, suddenly sailed over the fence into the boma, and Saiman and Mengeneera stormed through the gate in pursuit.

"This low-down cur of a M'Curry Curry is trying to run away!" exclaimed Mengeneera, stammering as he always did when in a rage, and he shook the boy whom he had tossed over the fence. .

Holding Pocket in front of them, the 17 Barotse gathered to one side of the clearing, the 40 M'Curry Curry on the other. Then Pocket broke loose and made a dash for the gate, the rest of the pack on his heels. The M'Curry Curry were going home. It was mutiny.

The Barotse waded into the mutineers with knobkerries, spears, sticks, fists, stones, anything at hand. A seething black mass, licked with light from the fire, tumbled in a corner. Peter and Jonas were trying to choke one boy, holding him against the wall of a hut. There was no sound but the thump of stick against skull, the thud of a fall, heavy breathing, curses, grunts, and the gasps of 60 furiously battling men.

Outnumbered more than three to one, the Barotse were fighting for the right to dictate to the M'Curry Curry, and all our plans depended on the next few moments. Unless the carriers were beaten into going on, the only direction in which they would carry was toward Southern Rhodesia and home, or they might refuse to carry at all.

There was a sudden lull, and the mutineers crouched in a corner of the fence, the Barotse threatening them if they moved. Mafaeking stepped to the front of his "brothers" and held up his hand, spitting scornfully in the direction of the M'Curry Curry.

He drew himself to his full height, his coppery torso burnished by the firelight, and paused for attention. No one so much as coughed, and then he let his deep voice roll. "I, Mafaeking, Mafaeking of the Barotse, speak to you—baboons." Not a whisper stirred in the silence while he scored the M'Curry Curry for yellow deserters. Speaking for all Barotse, conquerors and men, he tongue-lashed the "baboons." He told them how men, like himself and his brothers, met crises and work to be done. He was arrogant with pride of race, his every gesture majestic. "You will go through to Tete." He delivered his ultimatum. "I, Mafaeking, hunter for Lewanika, king of the Barotse, tell you so. And the Barotse kill—so." He finished with a significant strangling gesture about his throat.

There was whispering in the corner, among the "baboons." Then Pocket, the first deserter, stood up.

"We have made a mistake, Inkos. We will go to Tete."

On the twentieth day after leaving the Mazoe River in Southern Rhodesia, we saw the wide, blue Zambesi. The Barotse had brought us through.

Those Barotse! Before I had left Portuguese East I was to learn more of their quality. And on returning to Northern Rhodesia two years later, to finish what remained in our dreams of life with game and camera, they again proved that they were men among men. They haunted me. What was it in Barotseland, I wondered, that produced these leaders?

A spell is a spell is a spell, and although I had to wait seven years, I turned to Africa for a third time. I was determined to go to Barotseland and finally answer my questions for myself.

So once again I was headed for country about which no one could tell me much, following trails that were vague even to officials in Livingstone. At that time, the usual route into their country was by paddling for three weeks up the Zambesi River. And so at last I reached the home of those Barotse and lived among them for three months, learning of their traditions and the freedom with which they live a life that is their own.

Some months after I left Barotseland, the Paramount Chief Yeta III, son of Lewanika for whom Mafaeking once hunted, wrote me. As is the custom, he addressed me as "My friend." "My friend," Yeta wrote, "since you have left my country, we are living in peace, all people whom you know."

When I was in Africa again not long ago, I was unable to get north of the Limpopo River, but I inquired about the Barotse from an old friend, who covers the continent with a camera and had been among them since my last visit.

"They're getting surly," he told me. "They're not the same people you knew. In the past few years the Recruiting Agents have been allowed to go in and hire them for the mines of South Africa. You would find changes if you went back."

The Barotse have gone out to work for years, so it is not just the mines, I thought sadly. At the mines, there is no one to respect them if they lift their heads and say proudly, "The Barotse are known." Who cares? They are but anonymous workers, supervised by men steeped in the doctrine of White Supremacy.

At the mines and in the factories there is no call for the forthrightness and courage of a conquering tribe. Their manhood is denied, and they are merely "boys," classed as unfit to share in that white man's world they once thought glamorous and desirable.

And yet, as a friend of mine in South Africa once sadly said of the African, "It would be so easy to make friends of these people!"

So I had found it.

Continued from page 50

I am bound to add, however, that I doubt if this particular account is actually true. My reasons are simple. The distance involved here is so great that the chances of an accidental return are very slight indeed. Furthermore, there is, so far as I know, no reliable evidence that would render this anecdotal material credible.

Of course, cats can find their way home from any point in the territory with which they are familiar. This is based upon simple learning and is no more mysterious than a child's ability to walk home from school. Genuine homing ability may be something quite different. We're not certain as yet whether learning can account for the capacity of some birds to fly hundreds of miles over strange country and eventually return to their own nests. This is not the place to enter into a discussion of the various theories that have been proposed as explanations of homing; but it should suffice to state, more or less categorically, that there is no valid evidence to suggest that cats possess homing ability as distinct from the ability to learn their way about the world in which they live.

Written by an eleven-year-old boy:

"Thank you Grandpa, for renewing my subscription to NATURAL HISTORY, which is my favorite magazine and it would be terrible if I had to stop getting it."

Regular and Special Lectures at the Planetarium

The regular lecture at the Hayden Planetarium during February will be entitled "Conquest of Earth." It will demonstrate the close relation between astronomy and geography and show how the stars have aided man in mapping the earth.

Also in February, five special lecture courses will begin, on the following subjects:

Modern Celestial Navigation	Wed., Feb. 1	7:15 P. M.
Applied Navigation	Mon., Feb. 6	4:00 and 7:15 P. M.
Young People's Astronomy	Sat., Feb. 18	9:45 A. M.
Why the Weather	Thurs., Feb. 23	7:00 P. M.
Astronomy Without Mathematics	Tues., Feb. 28	7:15 P. M.

These one-lecture-a-week courses are carefully streamlined to clarify basic concepts in an authoritative yet not too technical manner. The introductory sessions, on the dates listed above, are open to interested persons without charge. For further information, call or write the Hayden Planetarium.

LETTERS

▲ GULL TALK: an unusual photograph taken by Karl Stulcken in Germany

Art by the Inventor of the Telegraph

New Yorkers will be given the opportunity to view from 35 to 40 paintings executed by the talented Samuel Finley Breese Morse, between January 19 and February 28 at the American Museum of Natural History.

The exhibition is being sponsored by the National Academy of Design as a tribute to its first president, who distinguished himself in the world of art on both sides of the Atlantic long before he became more widely known as the inventor of the telegraph. The exhibition also serves to inaugurate the 125th year of the establishment of the Academy.

Samuel Morse was a prolific painter. There is no record of the number of paintings that came from his brush, but 307 are known to be in existence today. They are catalogued in private collections and museums in this country and abroad. His full-length portrait of Marquis de Lafayette, considered by some critics as one of his finest, hangs in New York City Hall. It is being loaned for the exhibition. Others of his works are coming from a number of the foremost museums and from the private collections of the Morse family.

The only sculpture known to come from the hands of Morse is a plaster cast of "The Dying Hercules," which he used as a model to paint the subject on a canvas measuring 96½ x 78 inches. These works were executed in London by Morse in 1813 and received highest praise from the London critics.

In the beginning of his artistic career, Morse had planned to devote himself to historical paintings, but after his return to America in 1814 he set out as a portrait painter. First establishing himself in Boston, then traveling through several New England towns in quest of sittings, he eventually opened a studio in Charleston, South Carolina, where he was very successful at first, having at one time more than 150 commissions in advance. His portraits include many of the distinguished personalities of his day.

Morse, the inventor, will be represented at the show by a large and well-planned display of his accomplishments in the field of science and invention. Valuable pieces from the Smithsonian Institution will be exhibited, including the first telegraphic instruments used; medals the inventor received from foreign governments (Morse was the most bemedaled man in American history up to his time); pieces of the original Atlantic cable; the first Morse camera, which he used as a pioneer in the field of photography while professor of Literature of the Arts of Design at New York University; and hundreds of other Morsiana items from educational institutions, libraries, and historical societies.

Museum Spring Dance Series

Dances from Europe, Asia, Africa, and America will highlight the spring program entitled "Around the World with Dance and Song" at the American Museum of Natural History.

Uday Shankar, generally considered one of the greatest Hindu dancers of all times, will open the series on February 9 with a program composed of new works and repertory favorites from other years. Mr. Shankar, a superb artist of rare caliber, recently completed an engagement at the Forty-eighth Street Theater in New York.

On February 23, "Mara," foremost exponent of Cambodian and Siamese dancing, will offer the intriguing "Apsara"—dying art of the lost Khmer civilization which mysteriously vanished centuries ago. Delakova-Berk and Company will appear on March 9 in dance scenes from Europe, America, and the Near East; and Kolya and Vinya will present authentic dances from Russia on March 23.

On May 4 Pearl Primus, just back from a year's expedition in Africa, where she studied native dances on a Rosenwald Fellowship, will offer an exciting group of African ceremonial and social dances based on her studies.

Dances and music of ancient India by Wasantha Singh, Indian scholar and musician, and his daughter, Lakshimi, will be offered April 20. And for the final program of the series on May 18, La Meri and Myra Kinch will present a group of new modern works based on traditional ethnic forms.

The series, to be held in the Museum's main auditorium, will include an afternoon program at 3:30 P. M., to which children are admitted, and an evening program given by the same artists at 8:30 P. M. All seats are reserved. Information regarding tickets may be procured from Hazel Lockwood Muller of the Museum's Department of Education: ENdicott 2-8500, Ext. 248.

BOOKS

Continued from page 55

tation of what is known about the question of racial superiority.

The greater part of the book lies under the heading of Part Four: "Primitive Society." Here, Subsistance and Crafts, Marriage and Kin, Status and Social Role, Property, Social Control, and Religion are subheadings, under which are grouped brief but clear discussions of principles and classificatory units. In most instances, the material is illustrated by the description of an appropriate portion of a primitive culture. There is not too much of this—just enough to clarify the point that the author wishes to make. While the emphasis in this section is on the simpler cultures, there is enough reference to our modern civilization to make it clear that the forms and mechanisms being discussed apply to present-day western culture as well as to that of the Bakongo.

Part Five, "Society and Culture," discusses some of the larger concepts developed in anthropology—Society and Culture, Culture Areas and Culture Systems, Personality and Culture, Invention and Diffusion—and then gives what is perhaps the best presentation of present-day concepts of cultural evolution that has appeared in a textbook.

The book is written in an interesting style and is relieved by occasional bits of humor, but the bit on page 101 doesn't help much. I would like to see authority cited for the statement that roasted and pounded ants are "known as Shoshone *ante-pasto.*" The book is arranged in effective textbook format with bold type subheadings.

James A. Ford

AUDUBON'S AMERICAN BIRDS

from plates by J. J. Audubon
--- Edited by Sacheverell Sitwell

Batsford Colour Books, London, $2.00
12 pp., 16 illusts.

THIS slim volume, of crown quarto size, justifies the publisher's claim that it reproduces "directly, and with a fidelity of colour not hitherto achieved," sixteen selections from one of the finest illustrated works of all time. The exquisite plates were engraved and printed in the Netherlands. They testify to the marked superiority of European low-cost color work over any equivalent now obtainable in the United States.

The accompanying 12 pages (8000 words) of text by Sacheverell Sitwell are informing, discursive, gratuitous, stimulating (in the galvanic sense), opinionated, and sometimes exasperating. In the course of an essay dealing with ornithologists, artists, illustrators, authors, American Indians, New Zealand aborigines, game cocks (a masterpiece!), and what not, it is really possible to learn something about John James Audubon, his antecedents, collaborators, rank as a creative genius, and place in the Romantic movement that flowered contemporaneously in several arts.

It is no disparagement of the editor's sensitive appreciation of Audubon as a painter to point out how little Sitwell knows of birds and some other things. He extols the flowers in a number of the plates but omits, as did Audubon himself, to credit Joseph Mason, the lad who limned them around the master's birds. He informs us that the Carolina paroquet is "probably extinct"; that birds of blue plumage are rare in nature (which they are not). He obviously believes that our big American stork, the "wood ibis," is an ibis; that there is an "olive-sided nutcatcher"; that the wood duck and Carolina duck are different species. And he caps the climax with such solecisms as that the eider duck is more often found on rocky coastal islands than "in wooden swamps and hollow trees," or that "perhaps the African flamingo is a little paler, more roseate, than the American."

R. C. M.

A NEW THEORY OF HUMAN EVOLUTION

---------- by Sir Arthur Keith

Philosophical Library, $4.75
451 pp.

THIS new book by Sir Arthur Keith attempts to present the story of man's evolution and his differentiation into races. In Keith's view, the essential mechanism that controlled this lengthy process of a million or so years was the psychological nature with which the forerunners of man were endowed. This was a combination of dual but contrasting biases (derived from instincts): love for one's own kind and hate for others, co-operation and competition, together with a variety of other impulses that enforced these. By virtue of these innate characteristics, men in the primal days of their evolution were immured in small, mutually hostile, and competitive bands which as a corollary meant that they bred within their own group, thus preserving and working out the destiny implicit in this genetic endowment.

The fossil record of man's history is also analyzed in detail, and the author concludes that the various races of today all derive their origin from Australopithicinae in Africa, became separated at an early stage and evolved independently within their present geographic bounds.

Finally, modern nationalism is pictured as a continuation of the original, inbreeding primal group whose evolutionary function it has taken over.

Unfortunately, the conception presented here abounds in unacceptable assumptions and is open to innumerable objections. One cannot help feeling that the reputation of the author has not been enhanced.

Harry L. Shapiro

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ission: Malaria · Tar-Trap Treasure · Striking Rattl

ow Dangerous Are Animals? · Sky Survey · Sea Parro

Pageant of the Pacific

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LETTERS

"Monster's" Enemy

SIRS:

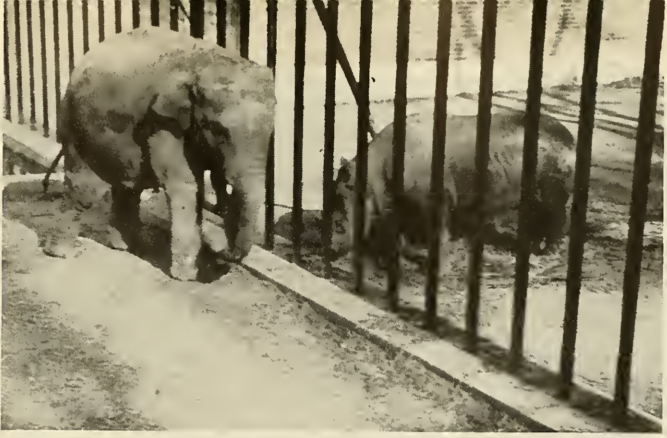
"Monster of the Mist Forests," in your January issue, contained the following paragraph on page 23: "Other than man, the black rhino has few enemies. However, one notable exception, or so legend has it, is the elephant. . . ."

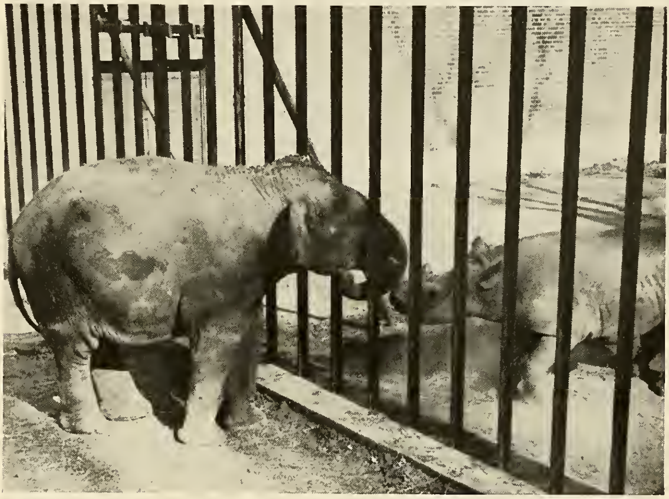
The "or so legend has it" brought to mind a scene I witnessed and photographed some years ago at the Brooklyn Zoo. The elephant and rhino had been standing "toe to toe" making threatening gestures at each other for some time. Finally, the elephant rushed the bars, brandishing his trunk. The rhino responded with a short charge that ended abruptly at the massive bars. The elephant took the round by turning quickly and smashing a left rear hook that shook the rhino, wedging his head between the bars.

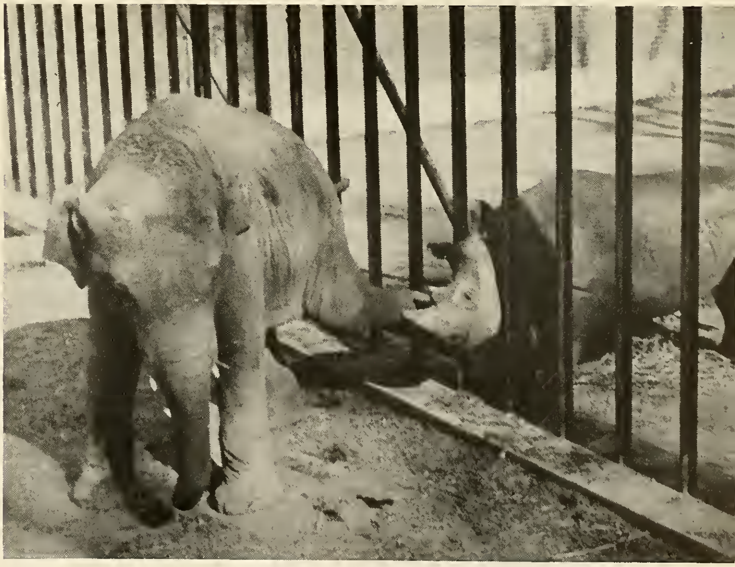
That seemed to take the fight out of the rhino. He withdrew his head, turned, and trotted off, snorting something to himself which I am sure would be unprintable if translated.

MURRAY GORDON

Bronx, N. Y.







Shy Turtles

SIRS:

This is to ask why turtles are so shy and fearful. I can't understand this when, as nearly as we have been able to observe during many summers at lake and stream, there is nothing except an occasional small boy that would threaten one of these animals. No creature on the Russian River is harder to approach. I have seen a half dozen or so flop hastily off a log when I quietly rounded a bend in the stream 100 yards or so away. Frogs and rabbits, both with many enemies, are far easier to approach. What teaches a turtle fear?

MAX. L. CONNER.

Alameda, Calif.

The following comments are offered by Mr. C. M. Bogert of the American Museum's Department of Reptiles and Amphibians:

The question of why turtles are so shy and fearful is not easy to answer. Some

NOTICE—Readers are encouraged to submit their own photographs of natural history subjects. Those selected for publication on these pages will be paid for at $3.00 each, with full credit to the photographer. Return postage must be included.

kinds of aquatic turtles are more wary than others, but even within a single species they may differ from place to place. Innate behavior may be modified by conditioning. That is, a turtle belonging to a species that is ordinarily wary may become used to the presence of animals that appear on the horizon but do not disturb it. Even the shyest of turtles in zoological gardens eventually are quite undisturbed by the presence of people. But if every visitor attempted to climb into the zoo's enclosures to catch the reptiles, they might retain what was probably the normal impulse prior to capture and flop into the water as soon as a human head appeared over the railing.

It may safely be assumed that the turtles in the Russian River, presumably Pacific pond turtles (*Clemmys m. marmorata*), have other enemies aside from the small boys that pester them. Innumerable animals devour the eggs or recently hatched young of most turtles, but the protective armor of adults discourages attack by a good many enemies. Nonetheless, there are various carnivores, including raccoons, possibly otters, and alligators in the southern states that readily crack the shell or even engulf the whole turtle if it's not too large. Without making a careful survey in the region, it is doubtful whether an adequate guess could be made concerning possible predators in the Russian River—but they are almost certainly present.

It is noteworthy that on some islands where predators are scarce or nonexistent the close relatives of wary mainland forms are often quite easily approached. The whipsnakes on Clarion Island, for instance, can be approached by man and picked up with ease, whereas their relatives in Mexico and the American Southwest are among the more difficult snakes to capture. Habits may be modified in this way, either by environment or by selection, to produce the same result. It has been suggested, for example, that in most parts of the South, where the remaining alligators take to the water upon the approach of man, such extremely cautious behavior is the result of selection. This is to say that the wariest animals have survived to transmit to their offspring what is assumed to be a hereditary trait. Early travelers in Florida reported these large reptiles to be present in great abundance, with the rivers literally swarming with aggressive alligators that did not hesitate to attack men in canoes. Now most large 'gators flee to the deepest available water before a hopeful observer can get a good look at them. In places where they are not actually hunted, as at Silver Springs, an occasional large individual may be seen basking on the bank of the stream, and boatloads of tourists can be brought within 50 feet or so. Yet a truly aggressive alligator is not likely to be encountered.

As for those Russian River turtles, they are probably molested more often than casual observation might lead one to believe.

"Stop, Thief"

Sirs:

In Rocky Mountain National Park, Colo., I placed a peanut on a rock, hoping to get a picture of a ground squirrel. Just as I was getting in focus, a bird zoomed in from apparently nowhere, I shot, and when I developed the film I was very happy to see I had made the exposure at the exact moment when this Canada Jay or "Camp Robber" picked up the peanut.

Mrs. Thase Daniel
Norphlet, Ark.

History of the Siamese Trees

Sirs:

This morning I received my February issue of Natural History, and after marveling at the colors of the Pinguin on the cover, I turned the page only to see a picture which took me back 46 years, to be exact. I am referring to the letter from C. J. Bates with the picture of the natural graft between the two sycamore trees.

Before reading Mr. Bates' letter, I knew exactly where these trees were. I was born in Rutherford, and when I was about ten or twelve years old I lived within a half mile of these trees. I remember when they were separate. The limb of the larger tree, when I first noticed it, was wearing a hole in the smaller tree, and we could hear it rub when the wind blew. Then, as the limb grew, it imbedded itself in the smaller tree, making a solid connection. Apparently the chafing of the bark by each tree started the graft.

It may be possible that someone before my time, seeing that this limb was growing straight toward the smaller tree, purposely cut off the end of the limb in the hope that it would grow into the other tree, as it did. However, since the readers of Natural History are nature lovers, let's believe that this was entirely the work of Mother Nature!

Arthur E. Davids.
Hartsdale, N. Y.

Sirs:

Referring to the Siamese trees that one of your readers described in the February issue, may I say that in a place at the outer end of Penzance Peninsula, Woods Hole, Mass., there are a number of European beech trees (*Fagus sylvatica*) that have become almost a tangle of natural grafting.

Bassett Jones
New York, N. Y.

"Rain of Frogs"

Sirs:

My husband related to me an interesting phenomenon that he witnessed while returning to Clarkia, Idaho, on horseback. A cloud suddenly appeared, followed by a severe thunder and lightning shower. When he reached a draw, the rain had ceased and the sun was shining, but the

Continued on page 142

NATURAL HISTORY

The Magazine of the American Museum of Natural History

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VOLUME LIX—No. 3
MARCH, 1950

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You will find NATURAL HISTORY Magazine indexed in *Readers' Guide to Periodical Literature* in your library

THE COVER THIS MONTH

This happy Hopi Indian is Jimmy Kewanwytewa of Old Oraibi, Arizona. He is a familiar figure to those who visit the Museum of Northern Arizona, at Flagstaff, where Jimmy is official "Custodian." The costume you see is typical of the traditional Hopi man — colorful headband, Dutch haircut, work shirt, and dungarees.

Jimmy spends much of his time carving kachina dolls and has earned an enviable reputation in this art. These colorful wooden dolls represent the spirits of many different supernatural beings. They are sometimes carried in ceremonials and later given to the children so they will learn to know them. More than 200 different kachinas are included in the Hopi pantheon. The dolls are brightly painted and decorated with hawk feathers.

Jimmy makes most of his dolls for the Museum's own collection, but a few are sold to lucky collectors. On week ends you will find him back at his family home, high atop an isolated mesa in the middle of the Painted Desert. There he relaxes with his relatives and plans the kachina-carving he will do the next week.

JACK BREED

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YOUR NEW BOOKS

Hopi Kachina Dolls • History of Science

Audubon • Water Fowl • Game Fish

NEW WORLDS EMERGING

-------- by Earl Parker Hanson

Duell, Sloan, and Pearce, $3.50
385 pp.

THIS is a readable and stimulating book, because its author is a stimulating and forceful man. He has seen much of the world and has given his best to help solve some of the problems that have arisen under a wide variety of human and environmental conditions.

Hanson's thesis is militant, but optimistic. Granting short shrift to racial prejudice and repression, he bets his purse on the underdog. He points out that "westward-ho!" has now run its global circuit and that civilization is busily turning at right angles into the traditional wastelands, *i.e.*, northward to the sub-Arctic and southward to the Amazon basin and similar areas. Now that man has more or less stopped insisting that these regions can't be occupied by people of high living standards and has begun to ask how best to bring it about, the end, writes Hanson, is assured. In his descriptions of the wide topographic and climatic variety within, for example, Alaska and Amazonia, and the resulting ecological niches for satisfactory human cultures, the author is reasonably convincing.

So far, so good. But it is hard to see why Hanson pooh-poohs such well authenticated, even if gloomy, pictures of man's plight as that in William Vogt's *Road to Survival*. Vogt surely learned his geography "in the field." In fact, Hanson to the contrary, there *is* no other kind of geographer.

Man has overbred in a large part of the terrain thus far found habitable. He has used up priceless resources nearly everywhere. Hanson completely ignores the fact that the destruction already stands up like a sore thumb in vast areas of South America and Africa, two of his pet continents. He plays up the African peanut project at a bad moment, because the current status of that grandiose plan augurs a fiasco.

Hanson's argument, indeed, falls frequently into traps of its own making. There is no parallel between the fifteenth century saving of Europe by the discovery of the New World and the "saving" of the modern horde of two billions (more tomorrow and mostly hungry) by the most intensive possible development of a residuum that is at least partly submarginal. The completely fascinating chapter on Iceland is a case in point. In all seriousness, it beats Horatio Alger, but Hanson is here dealing with a land of fewer than 200,000 people, a density of 3.3 to the square mile!

R. C. M.

I MARRIED A DINOSAUR

---------- by Lilian Brown

Dodd, Mead and Company, $3.00
268 pp., 18 photos

THIS is a bride's-eye view of a veteran fossil hunter. Lilian met Barnum Brown during a tour of India and married him there. Her book deals with the first two years of their marriage, spent in various parts of India and Burma.

Mrs. Brown relies a little heavily on the use of exaggerated slang, presumably for the sake of humor, but she does have the gift of natural writing, and many of her stories are genuinely funny. The descriptive passages are quite beautiful and reveal an excellent memory for details and impressions.

Very few women, I should imagine, could adapt themselves so cheerfully to camp life in a strange country. Lilian Brown describes as amusing several experiences that should have been, and perhaps were, rather terrifying. Her only complaint, throughout the book, is that her husband was too busy bone-hunting for them to have a real honeymoon.

Far from moping about it, she successfully occupied her time by making friends with the natives. Very wisely, she made no attempt to understand their way of life. She simply liked them, and they, her. In these days of suspicion and mistrust of any difference between peoples, such an approach is heart-warming.

In this account no dates are mentioned; this makes it difficult to place the book in time. This is a minor point, however, for the adventures of Lilian and Barnum Brown are so fresh and gay that they might have taken place only yesterday.

MARTHA R. BOGERT

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HOPI KACHINA DOLLS

---------- by Harold S. Colton

University of New Mexico Press, $7.50
20 figs., 8 in color; numerous line drawings

NEARLY every traveler to the southwestern United States—particularly if he is interested in the present-day Indian population—is familiar with the kachina dolls manufactured in the Hopi villages of northeastern Arizona. Perhaps he has acquired one of these engaging wood carvings and is curious to know its history and what it is intended to represent. It is to such an audience that the present handsome and informative volume is directed. It should in addition prove useful to the serious student of the American Indian.

To the Hopi Indian the term "kachina" is employed in three different contexts: first to mean a supernatural being, second to designate a masked dancer who, during certain ceremonies, impersonates this spirit. Thirdly, kachina refers to the small painted wooden effigies that represent both the supernaturals and their masked impersonators. After the ceremony for which they are made, these dolls are given to the children, not as mere toys, but as a part of the youngsters' religious training. Kachina dolls, therefore, are neither idols nor ikons but only objects used in the education of the Hopi child.

Since the Hopi recognize over 200 kachinas and frequently invent new ones, the problem of identifying any particular supernatural is complex. The Hopi art style, moreover, is extremely stylized and symbolic, so that the identity of a given kachina must be determined from details of the mask, body painting, ornaments, accessory objects, and the like. The two longest sections of the book are devoted to careful descriptions of the various kachina dolls and to a convenient key designed to assist in their identification. Both of these sections are abundantly illustrated with schematic ink drawings. There are in addition excellent photographic plates, eight of which are reproduced in full color. These latter happen to be the work of Jack Breed, who photographed the scene reproduced on the cover of this issue of NATURAL HISTORY.

HARRY TSCHOPIK, JR.

AN ILLUSTRATED KEY TO THE LIZARDS, SNAKES, AND TURTLES OF THE WEST

------------ by Jay M. Savage

Naturegraph Co., Los Altos, Calif., 50c
32 pp., illustrated

THOSE who want to make field identifications of the reptiles found west of the Rocky Mountains will welcome this 32-page pamphlet. It is small enough to be tucked into a shirt pocket and yet ample for the intended purpose, even to the inclusion of reasonably accurate distributional maps.

C. M. B.

THE QUAILS

------- by Edward S. Spaulding

The Macmillan Co., $6.50
123 pp., 7 color plates

THE scope of this volume is more restricted than the title would indicate. Aside from a chapter on the introduced Hungarian and chukar partridges, the author limits himself to the six or seven kinds of quail found in the United States. Of these, the best known is the eastern bobwhite, but all its handsome crested relatives are natives of the Southwest. Fortunately, Mr. Spaulding is a Californian, and he has made the most of his opportunities to study these engaging birds at all seasons and under all conditions. His informal accounts of their habits, though written as a sportsman, reflect a mature appreciation of nature and an enlightened approach to such controversial matters as predator control. Of the almost mythical masked bobwhite, long extinct in the United States and nearly so in Mexico, he of necessity speaks in general terms, but the chapter on the elusive and bizarre Montezuma quail contains much valuable, hard-won information.

The seven colored plates are the work of Francis Lee Jaques. Although the details are not always beyond criticism, these paintings possess striking beauty and will insure for the volume a somewhat wider audience than that provided by the sportsmen to whom it is primarily directed. For reasons undivulged, the elegant quail, a Mexican species scarcely mentioned in the text, was selected for the frontispiece.

DEAN AMADON

A SHORT HISTORY OF SCIENCE AND SCIENTIFIC THOUGHT

------- by F. Sherwood Taylor

W. W. Norton and Company, $5.00
368 pp., 28 plates, 53 figs.

THE author is the Curator of the Museum of History of Science at Oxford, and now science would appear to have, by title at least, a qualified historian. This short history covers a vast spread in scientific thought, ranging from the work of early Babylonian and Egyptian scientists to that of the scientific thinkers of today. There is a general running history of science, but certain concepts are treated in more detail, such as developments in the fields of chemistry and nuclear physics. Taylor thus attempts to show the dependence of today's science upon scientific thinking of the past. In general, the book is coherent and logical in its progression through time, and a generous sprinkling of illustrations serves to enlighten the reader. Included are many original drawings and diagrams of the scientific discoveries of the past. Four of the chapters give the reader a brief but informative history of the steps leading to the atom sciences of today.

A dynamic quality is given to this history by the inclusion of a series of short but well-selected readings from the great scientists from the Babylonians to Einstein. These selections help to orient the reader and give the flavor of scientific thought in the several eras of science discussed, which would be difficult to impart if done only in the words of a twentieth century historian.

It is only in the last chapter that the author becomes noticeably subjective and indicates his alarm over the path the world seems to be taking. He strongly expresses the opinion that it is high time that the men of science become ethical as did the men of medicine. Science is a tool, but the author realizes the power of the tool and thereby the power of the men who wield the tool. Taylor questions whether scientists will try to control their science. He does not answer this question but pleads for watchfulness in these significant times.

JOHN R. SAUNDERS

ALLEN LATHAM'S BEE BOOK

------------ by Allen Latham

Hale Publishing Co., Hapeville, Ga., $2.95
200 pp., 3 illusts.

THE incorporation of the author's name into the title of this book is appropriate, for after 65 years devoted enthusiastically to the keeping and observation of bees, a person presumably has yoked his personality so completely with the object of his interest that they form a complementary whole. The title has equal validity because the author inclines to be heterodox in his interpretations, and even his observations are often rather at variance with those of other investigators. Thus it is well to know from the start that the book is in large part a given individual's experience rather than a weighted summary of the conclusions of others.

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and mail it with one dollar, plus your name and address on a sheet of paper, for your copy of THE SCIENTISTS SPEAK. This clothbound book was published at $3.75. In it, 81 top American scientists explain how modern scientific findings in all fields affect our lives. Subjects include science of the earth, astronomy, bouncing molecules, the spectroscope, medical science, biology, polarized light, etc. Authors include Openheimer, Urey, Shapley, Hillier, Hooton, Compton and other well-known names. No clearer book for the intelligent layman interested in science. Book sent postpaid. Catalog listing other book bargains included FREE. Dover Publications, Dept. NH 2, 1780 Broadway, New York 19, N. Y.

The book will have special interest for fellow apiarists, who have faced problems of much the same character as those with which the author was confronted in the course of his long career. For many of these problems he found happy solutions. His interpretations of bee behavior are often stimulating, even if at times unusual.

One could wish he had taken more cognizance of the work of others, particularly in those cases where his own observations are at variance with theirs. His timetable of the successive functions—nursing, building, foraging, and the like—of the individual bee does not coincide with that of an investigator like Rösch; and his statement that bees follow the discoverer of a source of nectar takes too little cognizance of the conclusion reached by von Frisch, on the basis of painstaking experiments, that the character of the "dance" executed by the discoverer of the nectar reports the location with sufficient accuracy to dispense with the necessity of having the discoverer lead the way to the nectar supply.

The book has its defects. But as a personal record of an interested and enterprising apiarist with a healthy curiosity regarding his bees and their relatives (in which he includes the rather too remote termites), it is to be commended.

HERBERT F. SCHWARZ

THE SAGA OF THE WATERFOWL

------------ by Martin Bovey
Cover and title page designs
by F. L. Jaques

Wildlife Management Institute, $5.00
141 pp.

THRONGS of waterfowl once inhabited the vast marshes and innumerable prairie sloughs of North America. A slow decline in their numbers began almost with the arrival of the first western pioneers. Marshes were drained and spring shooting decimated the birds as they attempted to nest, while commercial hunters slaughtered them on Chesapeake Bay and other winter concentration areas. The abolition of market gunning, along with other protective measures, slowed but did not halt this decrease, for the destruction of habitat continued apace. Then, in the late 1920's, a series of dry years added their disastrous impact. The Dust Bowl appeared, and though its human casualties made their hazardous escape to California or other havens, nesting waterfowl

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were doomed. Belatedly aroused private and public agencies strove to improve matters by tightening game laws and by restoring marshlands. The results have been as good, perhaps, as could be expected, but the ever-increasing army of sportsmen and the ceaseless demands of agriculture make the future of our ducks and geese a precarious one.

This *Saga of the Waterfowl* is here depicted in a series of dramatic photographs. The text is merely a terse, running commentary that averages only two or three lines per page. Mr. Bovey's photographs are not waterfowl portraits; rather they are panoramic views of marshes and destroyed marshes, of duck hunters and would-be duck hunters who find their sport has vanished. When birds are present, they often are little more than silhouettes against sky or water.

Let us hope that this graphic plea for conservation will help us realize that wise management of marshlands and water resources is of crucial importance not merely to waterfowl but to man himself.

Dean Amadon

GAME FISH OF THE WORLD

- - Edited by Brian Vesey-Fitzgerald and Francesca LaMonte

Harper and Bros., $15.00
446 pp., 80 illusts.

THIS book, an authoritative and interesting treatise, is a compilation of contributions from well-known and widely recognized sports fishermen, including Major K. Dawson, Dan Holland, Lou S. Caine, Ollie Rodman, Philip Wylie, George C. Thomas, III, William W. Lovett, Jr., S. Kip Farrington, Jr., Ernest Hemingway, Michael Lerner, Van Campen Heilner, Leander J. McCormick, H. D. Turing, Norman L. Weatherall, N. K. Robertson, T. C. Roughley, Dr. Henry Gillet, W. W. Small, and Lt. Col. R. B. Phayre. More than 100 species of game fishes are shown in outstanding color plates by Dr. A. Fraser-Brunner.

Each contributor to *Game Fish of the World* was especially selected because of his knowledge of the subject on which he wrote and of the area or territory in which the fish under discussion lives. The result, combined with an excellent piece of editing, is a series of articles that are little short of amazing in their detailed coverage —something that all anglers can either read with pleasure or study with interest.

Game Fish of the World is divided into six parts, the first of which contains a thorough exposition on salmon. Part 2 takes in the favorite game fishes of North and South America, while Part 3 has the game and coarse fishes of Great Britain and Ireland as its subject. Australian game fishing is treated in Part 4, African game fishing in Part 5, and the game fishing of India in the last part of the book.

This one volume contains a variegated knowledge of the world's most highly-prized game fishes, knowledge that took each contributor many years of application and many thousands of dollars to learn. This information, thoroughly up-to-date, is now passed on so that other anglers may have the benefit of wide fishing experiences. Many gamesters that most anglers have heard of only vaguely are pictured in color, and the book will serve as an introduction to these gamesters.

In addition to these fine color likenesses, this introduction is complete with word pictures written by anglers who somehow manage to carry the reader along with them on the fishing trips they so vividly describe. Thus the angler is enabled, sitting comfortably by his fireside, to visit and fish (in effect) in such places as Alaska, Spain, the British Isles, Australia, New Zealand, South America, Africa, and India. It truly opens to the angler a piscatorial vista heretofore denied him, or enables him to relive the experiences of his own fishing trips to near and faraway localities.

In conclusion, we would unhesitatingly express the opinion that *Game Fish of the World* is perhaps the most useful volume on game fishing that has ever been presented to the angling public. That it deserves a special niche on the bookshelf of every angler goes without saying.

Erl Roman

NORTH AMERICAN FRESH WATER SPORT FISH

- - - - - - - - - by Lou S. Caine

A. S. Barnes & Company, $5.00
212 pp., 91 illusts.

THIS book is by one of the most unassuming, competent, and popular anglers in North America and is a thoroughly reliable job. The sections headed "Biological Facts" were written by Dr. Karl F. Lagler, an ichthyologist already well known to anglers as one of the coauthors of "Fishes of the Great Lakes Region," by Hubbs and Lagler.

The method of handling such material has become almost standard, but here there are several valuable additions. As usual, the fishes are arranged in their correct groups, headed by a short general discussion of the group as a whole. The individual fish is then taken up under various standard headings: name, scientific name, range, habitat, color, size, food, distinguishing characteristics, and a section called "biological facts" which deals chiefly with spawning habits and growth rate. To these more usual sections there have been added paragraphs on fishes as food and as game, and on artificial lures, and fishing methods. The most valuable addition of all, however, is the inclusion of a line cut for almost every species, illustrating the outstanding external peculiarities [or] distinguishing characters of the fish in question. These cuts are large and very clear and should be of great use to the angler in identifying his catch. The black and white illustrations and color plates are excellent.

At the end of the section on fishes, there are well-illustrated and clearly written sections on tackle and methods. These are followed by a reading list for anglers and an index.

This book has been prepared in a careful, orderly, and attractive way by a man who knows a great deal about fishes and everything about how to catch them.

F. LaMonte

THE SANDHILL CRANES

- - by Lawrence H. Walkinshaw

Cranbrook Institute of Sciences,
Bloomfield Hills, Mich.
202 pp., 5 maps, 18 pp. of illusts.

ONLY two species of cranes inhabit North America, but these stately birds have an importance for the naturalist beyond what mere numbers might suggest. Although the great white whooping crane is now nearly extinct, the brown sandhill crane is still found in many parts of the continent. For the past fifteen years, Dr. Walkinshaw, the author of this volume, has devoted the spare moments snatched from a busy professional life to an intensive study of the sandhill crane. His quest has taken him from the tundra of Alaska to the palm-dotted savannas of the Isle of Pines, accompanied at times by a pet crane, reared in captivity to throw further light on the behavior and development of this species. Zoos, museums, and libraries were also visited in his search for information.

The present volume, crammed with facts and supplemented with tables, bibliographies, and a key to the cranes of the world, is the result of this concentrated effort. Ecology, life history, migration, and conservation all receive detailed treatment. A book to be valued for either reference or enjoyment, it is a model of what an amateur ornithologist can accomplish by a carefully planned program.

Like other Cranbrook Institute publications, this book is well made. The cover design depicts a crane with neck upstretched watching three others in flight, while a beautiful Kodachrome of a sandhill crane taken in Alberta by B. W. Baker serves as a frontispiece. Of even greater value are 33 black and white photographs of cranes and their nests and eggs taken in all parts of the range.

Dean Amadon

A TRAVELER'S GUIDE TO ROADSIDE WILD FLOWERS, SHRUBS AND TREES OF THE U. S.

- - - - - Kathryn S. Taylor, Editor

Farrar, Straus & Co., $3.00
182 pp., 4 color illusts., numerous drawings

BOTANICAL publication has finally entered the automobile age in this streamlined little book, replete with reciprocating machinery that seems to work. Arranged according to color is a list of 743 species of trees, shrubs, and herbaceous plants, each with a few descriptive words and many with marginal thumbnail illustrations. The accompanying locality abbreviations are geared to three maps of the United States that show state boundaries and the major landform areas.

Part 2 is an alphabetical arrangement of states, each with an outline map and with such accessories as the best automobile routes and a picture of the state flower. The reader of the book travels along, and according to season sees by the roadside "drifts of sky-blue lupine" or "shrubby cinquefoil" or "dwarf iris" or "Scotch broom," depending upon the state in which he is traveling. Then he notes the catalogue number and turns back to the systematic list in Part 1 to find the scientific name and family and general distribution of the plant under observation, or one very closely related. This arrangement saves space and eliminates much of the difficulty with common names, which often vary from state to state. Then there are listed "Centers of Interest" for our botanical tourist, such as museums, national parks, experimental farms, etc. The mechanism seems to have been checked pretty well for the identity of material to be included. There is a good bibliography. It occurs to me that the list might have included *Southern Wild Flowers and Trees* by Alice Lounsberry which though published in 1901, does not seem to have been surpassed for this region.

H. K. Svenson

THE LIFE OF AUDUBON

- - - - - - - - - - - - by Clyde Fisher

Harper and Brothers, $2.50
76 pp., 20 plates, 53 figs.

THERE have been other more detailed biographies of this great painter-naturalist, whose plates adorn the walls of so many American homes. Yet this short life story, with pictures from the collection of the American Museum, will fill a definite need. Few men could better appreciate John James Audubon than our own Clyde Fisher, whose life was devoted to imparting enthusiasm for the study of nature and of our universe.

Audubon's life was nothing if not dramatic. Coming to Pennsylvania in his late 'teens, he was followed by rumors that he might be the lost Dauphin of France. The drawing of birds was his greatest interest. But he was expected to earn his living and so became a merchant in Kentucky. He had a loving wife, too, and soon there were two sons. His heart was not in business however; in another twelve years he was bankrupt.

At this point he found employment at the Western Museum in Cincinnati and decided to publish his collection of bird paintings. Many gaps remained to be filled; he started for Louisiana. "Without any money," he wrote in his diary of 1820, "my talents are to be my support and my enthusiasm my guide in my difficulties."

Before he could secure subscriptions to his "Birds of America," to be published in double elephant folio, he must visit Great Britain. For 20 years he traveled, hunted, painted, and edited; he proved himself by far the greatest salesman of natural history publications in his day.

That huge task completed, he settled in New York and soon was off again to the upper Missouri. The "Quadrupeds" were still to be done, but that work was only completed by his sons. Naturalists are apt to rate Audubon higher as a zoologist than as a painter. The artists extol him as one of their own. No doubt both sides are right.

James P. Chapin.

THE HISTORY OF NATURE

- - - - - By C. F. von Weizsäcker

University of Chicago Press, $3.00
191 pp., 8 illusts.

IT is no accident that the men who are most profoundly disturbed by the implications of our rapidly expanding science are frequently to be found in the ranks of physics where they come closer, perhaps, than any other group of scientists to the terrifying aspects of massive power over nature and mankind. It was possible, Dr. von Weizsäcker says, for scientists of an earlier age to ignore the responsibility

Continued on page 142

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MISSION: Malaria

By HARRY HOOGSTRAAL

Field Research Associate,
Chicago Natural History Museum

THE United States Navy has seldom sent a mission on stranger sea duty than it did in 1948 when the Naval Medical Science Group, accompanying the University of California African Expedition, fought its heavy trucks through the thick sands of the Libyan and Nubian deserts and into the Sudan to find and domesticate elephant shrews infected with malaria.

An earlier report of malarial infection in a shrew in the Sudan suggested to Dr. Clay G. Huff, of the Naval Medical Research Institute in Bethesda, Maryland, the advisability of attempting to find and isolate such a parasite. If a small mammal naturally infected with malaria could be adapted for laboratory use, it would be a great boon to research on this disease about which we still have so much to learn. A large part of malaria research must of necessity be done on animals, and birds have been the most convenient subjects. But because man is a mammal, studies of the disease in another mammal would be much more conclusive and directly applicable. It has been brought to light in recent years that part of the life cycle of malaria occurs in fixed tissues of the host, in addition to the well-known phase in the blood. This has made the demand for an experimental mammal even greater than heretofore.

So when my old friend Commander Kenneth L. Knight phoned by long distance and told me I would naturally want to join the naval group in Africa for the purpose of ferreting out this and other animal diseases, it was impossible to refuse. True, I was thoroughly enjoying the wonders of America after having just returned from three years in the Pacific. But my spirit of adventure rose as I contemplated the fascination of visiting more strange places and of hunting animals and diseases that research scientists have been waiting for years to see and study.

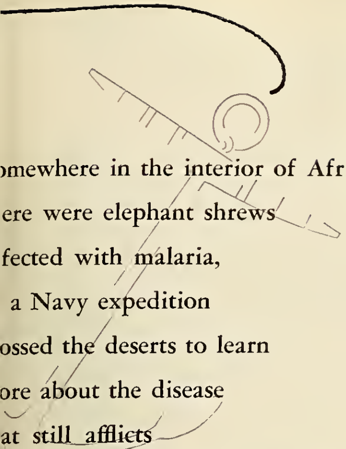
The informality of expedition life, the association with people in all stages of civilization and levels of society, the thrills of solving a varied assortment of problems, and the never-a-dull-moment atmosphere of the work, outweigh, in my opinion, not a few of the advantages and comforts that are to be found in the fast and troubled tempo of more civilized parts of the world.

To reach the land of the elephant shrew, near the southern border of the vast Sudan and eastward toward the wilds of Abyssinia, we headed our trucks southward from Port Said through the fertile Nile Valley, with its centuries-old water wheels, millions of domestic animals, and cluttered villages. At Assuan, in southern Egypt, the desert "track" began.

For about ten days we followed

Official U. S. Navy photo

▲ LINKS in the exploratory chain. *Left to right:* Chief Deaner K. Lawless, Medical Research Assistant, U.S.N., who worked with the author; William Terry, University of California representative; Captain J. J. Sapero (M.C.), U.S.N., who assigned the party to the project. *Standing:* Commander T. K. Ruebush (M.S.), Naval parasitologist, and Dr. C. G. Huff, Malarialogist of the Naval Medical Research Institute, who initiated the undertaking



omewhere in the interior of Africa
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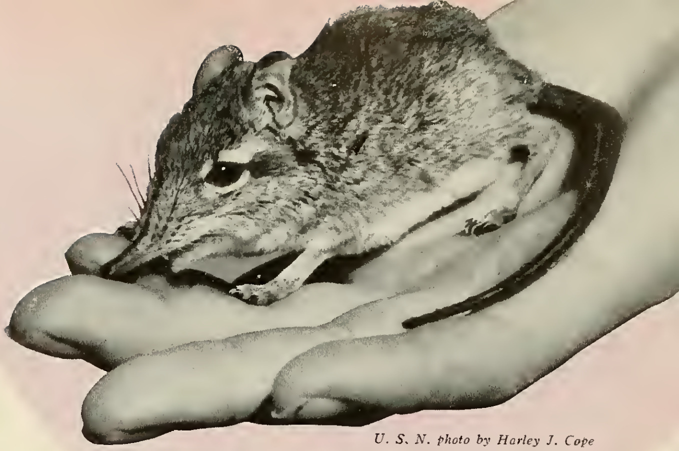
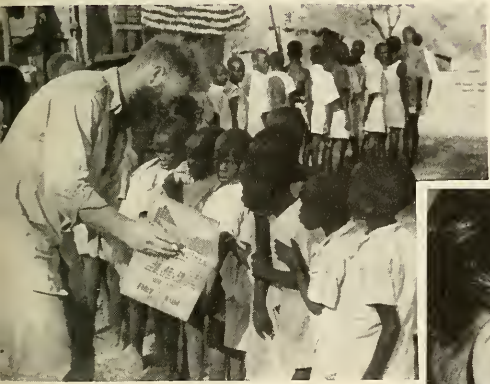


U. S. N. photo by Harley J. Cope

▲ THE OBJECT OF THE QUEST: the elusive elephant shrew, sought in the hope that this small mammal would shed light on human malaria



U. S. Marine photo by Charles Evans

◀ RICHARD ALISON showing the captive shrew to school children at Kapoeta so they would know what to look for. Soon they were bringing in dozens of them

▼ STROKING under the chin makes the elephant shrew's mouth water. Then the animal is easily "hypnotized" and will remain motionless for a considerable time

Harry Hoogstraal photo

a vague camel trail or only the intuition of our Arab guide. Though we traveled slowly, we still had to stop sometimes while our guide scanned the vista of peaks and hills for his familiar landmarks. More often, however, we were halted when our heavy trucks floundered in soft sand and had to be winched out by lighter and more mobile trucks.

There is little variety over this great expanse of desert but rather a magnificent monotony that, like fire or running water, compels one to look and look. Now as our party looks back on the year in Africa, we all agree that the days in the desert held our interest as much as anything we saw on the whole continent.

U. S. N. photo by Harley J. Cope

▲ HEADQUARTERS at Kapoeta. The author is showing the shrew to Commander J. M. Amberson, while Chief D. K. Lawless peers through the microscope at elephant shrew malaria

Even more than 25 miles from the nearest twig of vegetation a rare snake slithered from under a rock when disturbed, scorpions assumed their familiar offensive attitude, silverfish scurried away from their little piles of wind-blown debris, and praying mantises, curiously adapted for life in sand, raised their forelegs as they do the world over.

Scores of bleached camel bones along the track testified to the difficulty of the march, as did a human skeleton that our chaplain stumbled upon one day as he walked out to pray.

One day, our physicist was explaining how mirages are produced, when we noticed an unusual movement on the border of one of the lakes-that-were-not-there. Soon we were abreast of an advancing camel train of about 100 animals and a dozen men. Another night we were awakened from our bedding roll by the sounds of a camel train, wonderfully silhouetted against the cold, bright desert moon, shuffling through the sand and being urged onward by the low, steady chucking and calling of the drivers.

When we turned toward the Nile, where the hand of man has disturbed the serenity of the desert, the landscape lost much of its quiet splendor.

At Wadi-Halfa, the busy, sunbaked river town on the border of the Sudan, we paused to do a bit of medical investigating and mammal collecting. Then onward across hundreds of miles of desert, southward through the Sudan.

Just before Er Renk, about 300 miles south of Khartum, we left the country of the white-shrouded Arab and were startled to find ourselves abruptly among tall, thin, naked Negroes. During our next several months among these Nilotic tribes of the Sudan, we never ceased to admire them. Proud, primitive, sturdy, superstitious, honest, completely naked, and heavily ornamented, these Nilotics have been forced by the British to abandon most of their fierce intertribal warfare and to do some cultivating of the land; but otherwise, for the most part, they continue to live as they have for centuries past.

In the midst of this hardly tamed country lives the elephant shrew. A lucky clue dropped at Khartum during a conversation between Commander J. M. Amberson, who was in charge of our group, and an American missionary indicated that at Kapoeta in southeastern Sudan, these snouted little animals could often be seen running about in broad daylight. If we hurried we could skirt the tremendous morass of the Nile sudd just before the rains closed the packed mud road for many months to come.

At Juba, the last British installation in the southern Sudan, Commander T. K. Ruebush, Naval parasitologist, found so many important medical problems that he was regretfully forced to turn the elephant shrew project over to his assistant, Chief Deaner K. Lawless, Medical Research Assistant, USN. Chief Lawless entered eagerly into the work, and once at Kapoeta, we were soon spending sleepless nights searching for the pot of gold at the end of the rainbow—elephant shrew malaria.

At first we failed to get even a smell of what we had come for. Richard Alison, my bushy-bearded New Zealand soldier-of-fortune assistant, and I placed dozens of traps

▲ Chief Deaner K. Lawless buying elephant shrews from Taposa men at Kapoeta

Harry Hoogstraal photos

in the likeliest spots. All we caught in them were rough-haired grass rats and tiny, beady-eyed true shrews. Then, at last, a sick, maimed elephant shrew crawled into one of our traps one night to find a place of refuge.

The poor animal had little peace after we discovered it, for we collected everyone in camp to see the little beast that had lured us so far off the beaten path. In a moment we had a drop of its blood on a glass slide. It was stained, waved in the air to dry, and placed under the microscope. After the first quick look, everyone knew that we had found what we were looking for. Indeed, our first elephant shrew had the heaviest density of malarial parasites that we were to find in hundreds of animals examined during the next few months!

A day or two later, Major R. M. Allott, the commander of the local Sudan Defence Force base and the only Britisher for miles around, returned to Kapoeta and, being apprised of our need for large quantities of elephant shrews, took hasty action. Summoning the prisoners, the soldiers' children, and the native population, he had Alison parade the cage containing our prize elephant shrew up and down the lines of people, tell them what the reward was for each living specimen, and chase them off to capture more.

The elephant shrew that the people had seen in the cage was a reddish-brown, thick-furred little animal, some eight inches in length, about half of which was almost naked tail. Its hind legs were elongated like those of a rabbit, its forelegs reduced in length. The large, dark eyes, specialized for night vision, were offset by a conspicuous circle of white hairs. Most interesting of all was the long, pointed,

▼ A familiar scene in the field laboratory: microscopic examination of elephant shrew blood

grooved snout, which the creature moved actively up and down when excited or investigating food.

The elephant shrew appears to most people to be a strange kind of rat. It is not a rodent, however, but an insectivore. Thus it belongs to the most primitive of mammal orders, the same one as the hedgehogs. The species with which we are dealing has recently been identified as *Elephantulus rufescens rufescens.* About 30 forms of the genus are found in Africa and Asia Minor but nowhere else. They range from Algeria to the Cape, but we believe that our species is the most northerly one in East Africa. A few elephant shrews in other families and genera grow almost to the size of half-grown rabbits!

Elephant shrews were seen easily enough at Kapoeta in April, for the clump grass was burned to short, blackened stubble. The rains that cause it to grow taller than a man had scarcely started. Now only low tree or bush acacias and thick clumps of a cactus-like euphorbia grew in the heavy clay "cotton soil." The little animals liked to hide under these or under the highly protective fences which the Taposa make by throwing up the spiny branches around an area they intend to cultivate during the rainy season.

We often saw the animals in the morning and in late afternoon but only seldom during the heat of the day. They were difficult to detect when motionless but were easily startled into running when a person approached. They hated to leave their runways, but if desperate to escape they often disappeared into the long, deep fissures that broke the earth during the dry season.

Groups of four or five Taposa men or boys were able to harry the elephant shrews into a senseless flight that ended in the cupped hands of one of them, and so our first lot of research animals was accumulated. Men earned a week's wages in a few hours; but the British were not disturbed, for they said the situation was so temporary and unusual that it would hardly upset the economy of the tribe.

The Nilotic tribes, most of whom refer to the elephant shrew as *ikabok,* say that they come into their huts at night and that they eat rats. The former story may be true, but with their small teeth and weak jaws we find it impossible to believe the latter one. The natives also consistently say that the animals disappear during the rainy season, but this is undoubtedly an assumption based on the difficulty of seeing such small creatures in the thick grass.

At Torit, about 100 miles west of Kapoeta and about 80 miles east of the Nile, we found a different tribe of Nilotics, the Lotuka. And here we encountered the elephant shrew under very different circumstances. After searching in vain under acacia trees in the grassland, we went farther away from the settlement where there were few if any single trees in the grass. There groups of several trees of different kinds formed dense islands of vegetation. Below the trees were vines and shrubs and a few succulent and herbaceous plants. Outside in the uniform grassland the sun was hot and glaring, but inside the islands of vegetation the temperature was several degrees cooler, and there was little light. Each island might measure from 10 to 30 feet in width and from 30 to 70 feet in length. In these shady refuges we found the elephant shrews.

After we had visited a considerable number of these islands, I came to the conclusion that the islands had been able to establish themselves in the dense grass because of the large termite mounds that dotted the area. When the termite mounds are in active operation, no plant can grow on their hard, sun-baked sides. But when successive rains beat down abandoned mounds, their consistency changes and seeds that fall on them germinate and develop into plants. The chemical characteristics of the soil on these mounds is apparently more favorable for tree and shrub seedlings than for grass, and gradually, as the first intruders grow and produce shade, others are able to gain a foothold. Thus the islet becomes an ever-growing island of dense, heterogeneous vegetation.

The elephant shrew runways in these islands were eagerly pointed out by the Lotuka guides, who had been assigned to us by the Torit District Commissioner, Mr. John Owen. Each of the dozen men and boys carried his own equipment for catching these animals. It consisted of several small bows but no arrows to shoot from them. Instead, they bent each bow into an arc and tied the sagging string into an ingenious noose about two inches from one end.

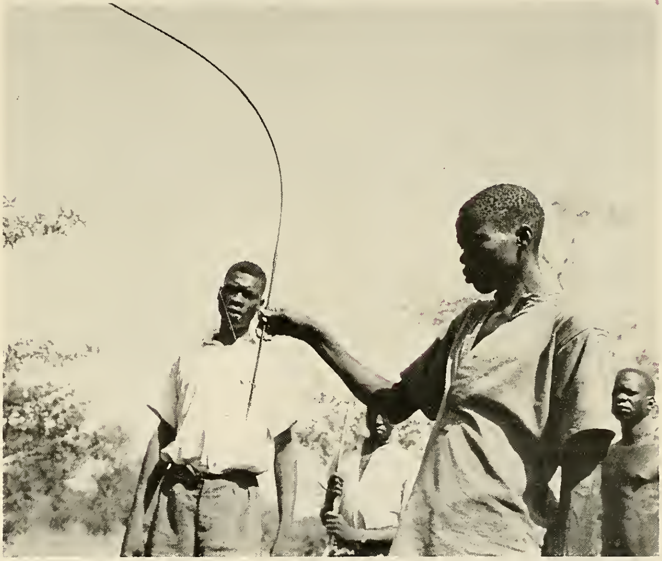
When all the bows in the party had been so prepared, the men chose one end of a large island of vegetation that showed a number of fresh runways. In each narrow path they thrust several bows upright so that the noose was just above ground level. Now that every pathway was covered, they retreated to the outside of the island and started shouting, throwing stones, and beating the vegetation with sticks. Scared by all the commotion, the shrews fled down their familiar runways and trapped themselves as they reached the nooses. About half of them were instantly killed, but the others were unharmed, and these we placed in cages.

This method of obtaining live specimens worked quite nicely at Torit during the dry season, but when we needed more during the rainy season, we ran into serious difficulties. Our quarry was seldom where we had come to expect it to be. The animals took advantage of the shade and concealment offered by the grass that had sprung up so densely with the rains, and left their dry-season haunts to roam far and wide. Added to this, we had difficulty in getting enough Lotukas to accept the time-consuming job at this season. Normally they divide their activities, hunting during the dry season and cultivating their millet fields and caring for their goat herds during the wet season. As it is, the District Commissioner has to force them to cultivate by sending police and soldiers into the village, and we could hardly assume the blame for subsequent starvation by interfering with his program. So we assembled the few available men

◄ A far cry from the clinical laboratory: natives and their policeman-boss setting out to catch the little animals near Torit

▼ The bow and noose devised by the natives for catching the shrews as they fled down their familiar runways

Harry Hoogstraal photos



and boys, obviously not the most experienced, and offered them huge bonuses. We taxied them to and from the hunting grounds and helped them as much as we could; but the results were always disappointing. Our own live traps yielded nothing but grass rats. At last we were forced to load cages on porters and obtain our animals from a more distant village where the grass was shorter.

That is the story of the capture of the elephant shrew. But the laboratory aspect of our project and the domestication of the animals are another story.

Lawless and I had to find out as much as we could about the malaria that we found in the animals and try to adapt them to cage conditions. One of our first jobs was to determine what they ate and to provide a suitable diet that could be easily and inexpensively offered them in the laboratory.

We found by stomach examinations and feeding experiments that termites and some kinds of ants were their favorite food, though they did eat some other insects and a small bit of vegetable matter. They could not cope with large grasshoppers, and the shells of some beetles were too hard for them to crush. Other insects must have had an offensive

William Terry photo

◄ The author showing a native how to hold the shrew when transferring it from the noose to the cage

Harry Hoogstraal photo

▲ **Collecting** mosquito larvae in tree holes near Torit: Chief Deaner K. Lawless searching for the insect that carries elephant shrew malaria

odor, for they, too, were disdained.

If wingless termites are their "meat and potatoes," fat winged termites are to the elephant shrew what ice cream is to the American child. Whenever the winged termites left their nests, a feast day was proclaimed, for they are also much relished by the Nilotics. The natives have two clever ways of obtaining them. Rain induces the winged members of the colony to fly out, and so the natives imitate the patter of rain by tapping on the side of the termite mound. To make sure of the illusion, they pour a few drops of water down the opening. Then the termites fairly gush forth and are easily collected. Or when natural rain induces the termites to leave, the Nilotics build a fire over a pit dug near the mounds. The termites, attracted by the light of the fire, fall through the flames into the pit and are scooped up to be eaten or sold to the less industrious natives—or to us as elephant shrew food.

Other insects were extremely rare during the dry season at Kapoeta, and we had to depend almost entirely on termites. Large termite nests dotted the landscape, but the inhabitants, living in considerable self-made heat underground, were seldom near the surface or openings, and the sun-baked walls of their castles were most difficult to break into. Another termite, which makes a small domed mound lined with cut grass stems, was more readily obtainable, but we quickly consumed the local colonies.

When quantities of worker and soldier termites or ants were placed in the elephant shrew cages, so many of the insects attacked the animals and attached to their feet, tails, and ears that they cowered in the corner in fright. Wanting to get them started on an artificial diet anyway, we began giving them chopped meat—whereupon almost all died.

It was difficult to fight off depression as—without elephant shrews—we struggled back to Juba over rain-soaked roads in our jeep. After the first day with the rest of the party, our spirits revived, and we blatantly announced that we were sure we could keep the animals alive if given half a chance. After deliberation, the Commander, always a good sport for a challenge, told us to go ahead and try our luck. He headed down to Kenya with his party.

Our second attempt was a complete success. This time we set up operations in two *tukals* (small native-type huts) in the yard of the Juba Hotel and brought our catch in from Torit. Jock Graham, the generous Scotch manager of the hotel, loaned us his carpenter for making cages. He also provided the various foods that we offered the animals in our attempt to determine their preferences, and he helped us in many other ways.

Small children with bug-nets could be seen all over the Juba landscape as they chased the plentiful grasshoppers for our elephant shrews. But we were still anxious to get our charges started on a diet that would be practical under laboratory conditions. Graham gave us small wax-paper dishes, and after some experimentation, each shrew was fed nightly with a dish of oatmeal and milk, chopped meat, chopped eggs, and a "come-on" of live grasshoppers. This is the same diet that later was fed them in the States, except that meal worms were substituted for grasshoppers and termites.

We fed newly-captured animals with milk from a medicine dropper. All but a few were eager to accept this strange food, but they showed little interest in dishes of milk in their cage until taught to drink. We would hold one with its snout almost in the dish and force the dropper into its mouth. As it drank we would slowly withdraw the tube into the dish of milk. The animal would then lick the sides, and finally the milk, from the dish. We felt that they needed this sustenance during the initial period when they were eating but little.

However, we were concerned over the radical departure from their

➤ **Native,** elephant shrew, an
Gladys Terry, wife of Administra
tive Director, University of Cal
fornia Navy African Expeditio

usual diet. Obviously they ingest no liquids during the long dry part of the year when little if any dew falls. The few stream courses are completely dry during this season, and rivers are many miles away. We suspected that some animals that died with distended bladders were adversely affected by the milk, but before we could prove this point one way or the other, they began accepting their new diet and our worries were over.

Chopped meat was always quickly accepted, but some individuals ate chopped eggs while others refused them. None displayed an interest in dry rice, peas, or lentils, though the natives insisted that they did eat grass seeds.

We noted that they refused to eat any food until they had touched and sniffed it with the tip of their long snout. Once they had decided the food was palatable, they might hold it down with one or both forelegs. The head of an insect was always eaten first, then the thorax, and lastly the abdomen.

The elephant shrew is a slow eater and often rests between mouthfuls. But a meal of winged termites was an exception: they were always eaten without a pause. Cage partners often fought over a grasshopper that one was eating, even though several other grasshoppers were only an inch or two away. The males were usually the aggressors in these fights, but a few females dominated their mates similarly. During the daytime they were clumsy about catching grasshoppers in their cages, and several attempts were usually necessary.

Housing our little beasts became a project out of all proportion to their size. It had been impossible to carry cages on the long trek to the Sudan, and materials for their construction were scarce, to put it mildly. Southern Sudanese carpenters are painstaking, but they seldom rush about anything. The easiest cages to construct were simple boxes with tops that could be lifted off. However, we spent so much time chasing escapees that we quickly decided upon sliding-door cages, even though they were slower to construct. Even then, if the wooden door shrank, as it usually did, the shrews used their snouts ingeniously as levers for moving it aside.

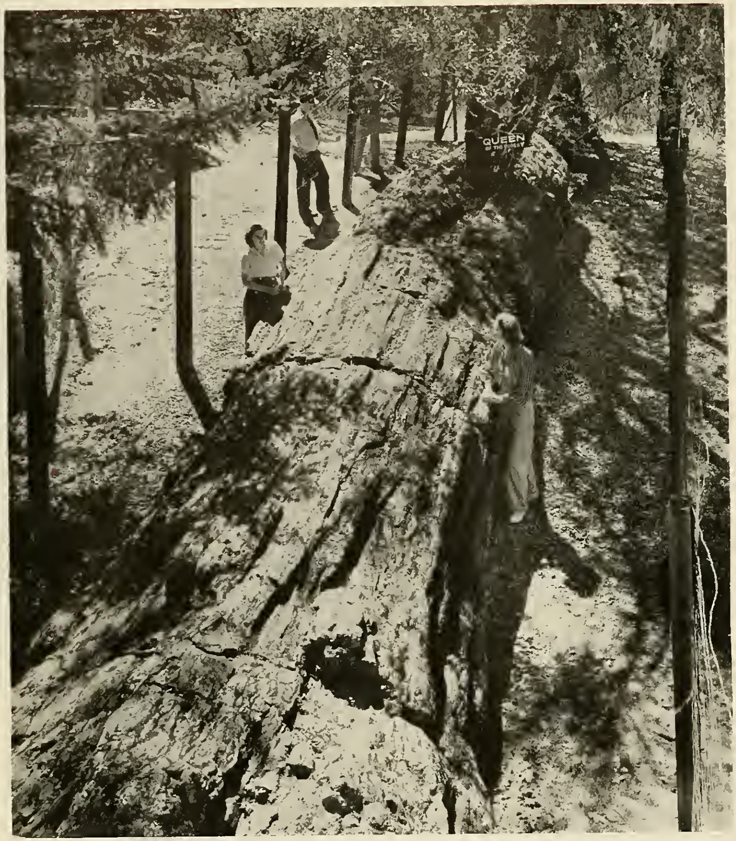
When the elephant shrews escaped from the building, they usually hugged the outside walls and were easily recaptured. A few darted across open ground to a building 25 feet away, but there they stayed and were also easily retaken. One eluded us for two days until a boy chasing grasshoppers saw it, bedraggled and unhappy, in a drain pipe of the near-by building where it had probably been all the time. During the daytime, the fugitives ran on all four legs, but at night they made for their objective directly with great hops on their hind legs, the short forelegs touching the ground only briefly.

When we caged several animals together, they huddled in a pile, and their combined heat changed their sleek fur coats to soggy mats. Their abject fear was caused by domineering males who scratched and bit at any member of the group that dared move. So, as quickly as we could, we obtained enough cages to keep pairs separately. The animals obviously preferred to be with at least one other. Whenever one in a single cage could climb over the partition and huddle next to another animal, it would do so. We noticed that if we removed both from a cage and then put one of them back in

Continued on page 140

Gladys Terry photo

▲ William Terry and the author feeding newly-captured shrews with milk from a medicine dropper. Development of a diet on which the animals would thrive under observation at the Naval Medical Research Institute required considerable experimentation. These are probably the first elephant shrews ever to reach the United States alive



▲ "THE QUEEN" of the petrified giants: one of the huge redwoods that were overthrown several million years ago by a volcanic eruption and then turned to stone

▼ MT. ST. HELENA in California's Coast Range, at whose base the stone trees lie. It was here that Robert Louis Stevenson honeymooned with Fannie Osbourne and wrote *The Silverado Squatters*

STON

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Millions of years ago these monarchs met a violent death, yet in the strange manner of their destruction they were preserved for all time

By

DOLORES BUTTERFIELD JEFFORDS

Photos courtesy of the Redwood Empire Association

THE scene: the westernmost edge of a great continent. The setting: a forest of giant redwoods, towering to a height of over 300 feet, against the backdrop of a mountain range. The time: several million years ago.

Many of those redwoods had been growing in that kindly soil for some 3000 years. How many thousands of years longer they might have flourished there, no one can say, for the natural life span of the redwoods is still undetermined. So far as is known, they never die—they succumb only to violence, as did these. The mountain at whose base they grew exploded and gave forth ash, mud, and red-hot lava, which spread desolation for miles around over the quaking earth. When the eruption was over, the forest of giants lay prostrate under a vast blanket of volcanic waste.

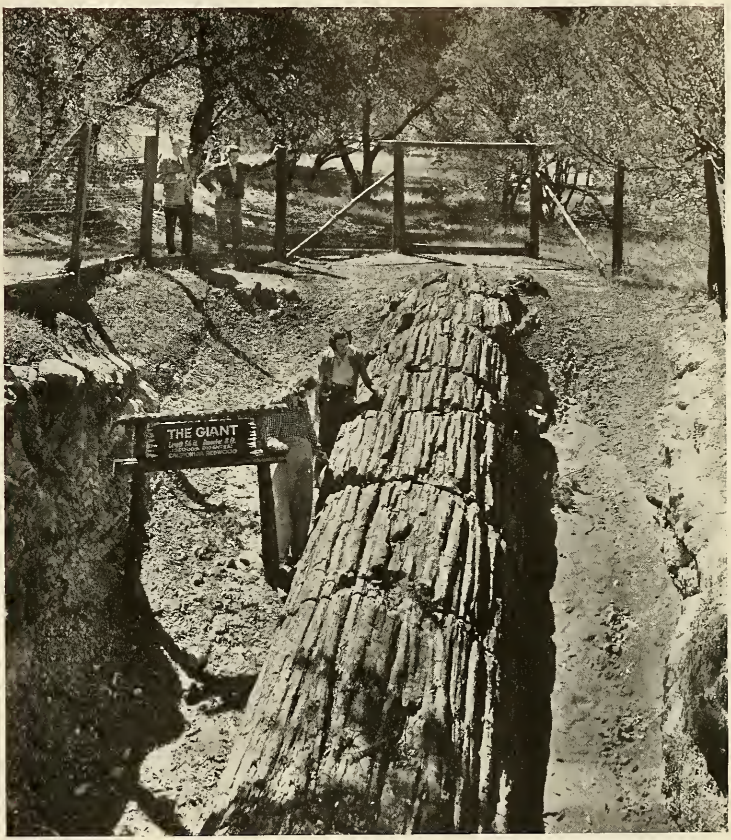
Thus has science reconstructed the prehistoric drama of Mount St. Helena and the underground petrified forest in Sonoma County, in California's Redwood Empire. Their long imprisonment beneath the volcanic ash transformed the huge trees into columns of siliceous

TREES

ood Empire

rock. In 1871, the tract was discovered, and gradually since that time a number of the trees have been excavated in an area about one mile long by a quarter of a mile wide.

Unlike other petrified forests, which consist largely of stumps and broken fragments, this one is composed of huge trunks of the largest of all trees, many of them almost entire. Many have been uncovered at a depth of 90 feet below the present ground surface, lying one above another, their tops, with significant uniformity, pointed away from the mountain that destroyed them. Yet, in destroying them, it preserved them for all time—preserved them in stone, with the most minute perfection of bark and grain and even of the growth rings that reveal how many centuries they stood there before the eruption felled them.



▲ "The Giant," like the other trees in this fallen forest, apparently lost its top before petrification could preserve it

▲ Geysers, mud-pots, and mineral springs give evidence of the subsurface activity that caused the ancient cataclysm

The process of petrifaction included a few worms embedded in the wood of some of the trees. And leaf imprints have been found, although the petrified trunks are topless and rootless, as if the extremities of the trees, less completely covered, had disintegrated before subsequent eruptions or the accumulated soil of thousands of centuries buried them more deeply.

The individual trees of this stone forest have names, the most celebrated being "The Queen of the Forest," "The Giant," and "The Monarch." "The Queen" is a tremendously massive column 80 feet long. "The Giant," despite its name, is smaller—56 feet long and 8 feet in mean diameter. Being redwoods, these trees must have been taller; part of their length must not have been fossilized. Both of these trunks are broken into several sections, but there is no displacement to mar the impression of the whole, except that two sections of "The Queen" have been thrust apart by a thriving live oak that has grown between them.

"The Monarch" is the most perfect of these petrified redwoods, having an unbroken length of 126 feet excavated thus far, part of it exposed, part lying in a tunnel dug around it. When fully excavated, it is believed it may be 300 feet long. Its age at the time of the eruption may have been 3000 years.

There are petrified pines among these trees, easily distinguishable from the smaller redwoods by their perfectly preserved bark texture.

Mount St. Helena has long been peacefully extinct. It is a domi-

▲ FORESTS again clothe the slopes of the long-inactive volcano. Today the region is a favorite vacationland, accessible by a network of all-year highways

nant peak of the Coast Range and was named by the Russian settlers who, despite protests of the Spanish government and the succeeding Mexican government, held possession of northwestern California from 1811 to 1841. It was on Mount St. Helena that Robert Louis Stevenson honeymooned with Fannie Osbourne in 1880 and wrote *The Silverado Squatters*. The site of the bunkhouse they occupied on the mountainside is marked by a monument dedicated to the famous author, representing an open book.

St. Helena is beautiful now. Forests again clothe its slopes below the high, bare peak, and orchards blossom around it. A modern highway winds to the top, where the Russians placed a tablet in honor of their empress. The surrounding area abounds in geysers, hot mineral springs, bubbling mudholes, fumaroles, and other post-volcanic phenomena. And near by is a mountain of obsidian, a mass of black volcanic glass. This is the locale of many health resorts, a year-round vacationland, a place of both historic and prehistoric interest, and a favorite region for scientists to study the continuing thermal activities near a long inactive volcano.

But the outstanding exhibit of the region is the Petrified Forest at the base of Mount St. Helena, on the Petrified Forest Highway, five miles west of Calistoga. How far that buried forest actually extends, how deep some parts of it may lie, will perhaps never be known. Nor can we guess how many other such forests, laid low by cataclysmic upheavals in past ages, may lie in the Redwood Empire under the roots of their towering descendants of today. It is enough that here, imperishable even in death, vastly older than the oldest present redwoods, are giant trees that lived and flourished millions of years ago; trees that for eons of time lay under the earth, to emerge at last transmuted to stone, with lifelike preservation of every mark, grain, and fiber. Here, in the light of another day, infinitely removed from their own, they can only be viewed with wonder and awe and with a profound recognition of the fact that, despite all our scientific advancement, there are still "more things in heaven and earth . . . than are dreamt of . . ."

Sea

THE quartermaster at the wheel nodded in the direction of a dark heavy-bodied bird that veered sharply into the twenty-knot breeze to miss the "Penguin's" pilothouse and skim heavily over her spray-drenched bow. "That bird is a sea parrot," he volunteered, "but they can't talk," he added, with the air of one who has been disappointed. "All they can do is bite, and they do that mighty well. Better not let one get ahold of your finger or he'll pretty near take it off." I didn't interrupt him to say that to landlubbers the bird is known as a tufted puffin, since to sailors all puffins are "sea parrots."

We were aboard the motor ship "Penguin" on her May trip to the Pribilof Islands. Five times a year she makes the 5,000-mile round trip to carry supplies from Seattle to the fur seal islands in the middle

Parrots

Some birds stand to lose more than feathers during the postnuptial molt. Take the puffin, for example

By Karl W. Kenyon

U. S. Fish and Wildlife Service

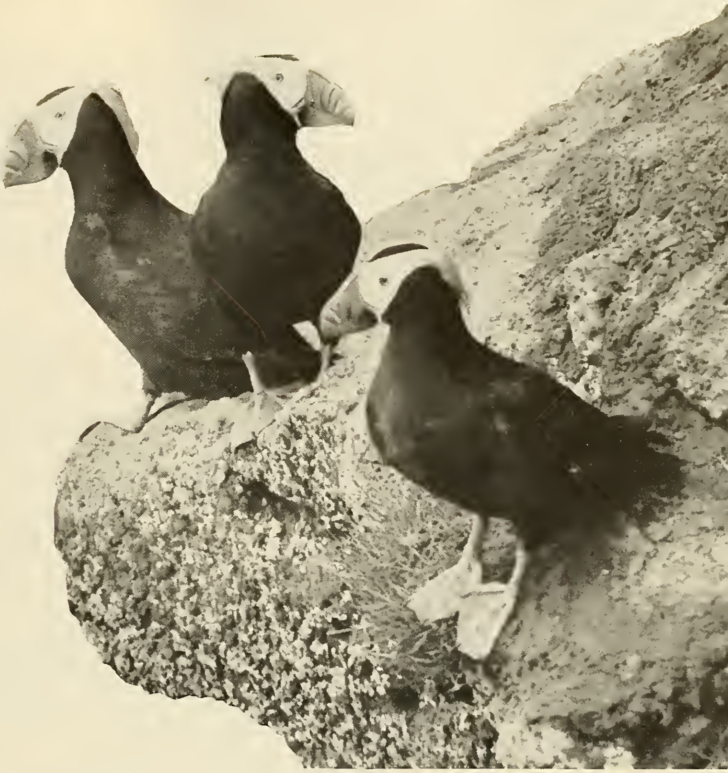
All photographs by the author

of the Bering Sea. As we rolled and pitched through the rough, dark waters of the Bering, still over 100 miles from the Pribilofs, two species of puffins frequently skimmed near us over the choppy sea or rode like jaunty corks on its surface. Sometimes those swimming in our path turned sharply into the wind and, bouncing from one wave crest to another, finally lifted their chunky bodies on rapidly beating wings into the gusty wind. Others, with apparently no intention of actually becoming air-borne, simply folded their bright orange feet back across their rump, as if to get them out of the way, then hydroplaned over the surface on their bellies, using their wings as giant oars, until they were well clear of the ship.

"Even at a distance you can tell the two kinds of sea parrots apart," the sailor went on. "One is white underneath and the other is all black, except for his white face and ear tufts."

The sailor referred to the two species of puffins found in the Pacific and Bering Sea, the dark-bodied bird being the tufted puffin and the one with the white underparts the horned puffin. Puffins are characteristic of northern seas. Like other members of the auk family, they are circumpolar in distribution and seldom venture south to warmer waters. An Atlantic species ranges from the Arctic southward to the British Isles, the coast of Maine, etc. It embraces three geographical races, but they are indistinguishable in the field.

▼ The author's valuable Aleut assistant, Lavrenty Stepetin, who knew how to handle puffins and had due respect for their strong, sharp bills. The birds are well aware of the strength of their bills and inflict painful cuts if carelessly handled



▲ Two species of puffins are abundant on the Pribilof Islands. The tufted puffin, shown here, is all black, except for its white face and ear tufts, whereas the horned puffin is white underneath. Puffins appear to prefer the company of their own species

The tufted puffin enjoys a wider breeding range than any other bird found nesting on the Pribilofs. It nests on many of the small islands along the west coast as far south as Anacapa Island off Southern California. The horned species, like its relatives in other northern seas, is confined to more northerly areas and nests only on the islands of the Bering Sea and along the coasts of Alaska and Siberia. Even in winter, few of them venture south as far as California. Dead specimens have been picked up on the beaches of Southern California, but these birds were probably storm-driven individuals that became weakened by heavy winds and seas, finally to wash ashore south of their normal range.

Other sea birds besides the puf-

▲ **Puffins** are sociable birds; they often gather in groups, as shown here, to enjoy the company of their neighbors

➤ **Benny Melovedov**, an Aleut boy of the Pribilof Islands, holds a puffin chick. Although the young puffin used its bill on fingers that came within reach, it was not strong enough to inflict cuts, and it lacked the aggressive attitude of an adult puffin

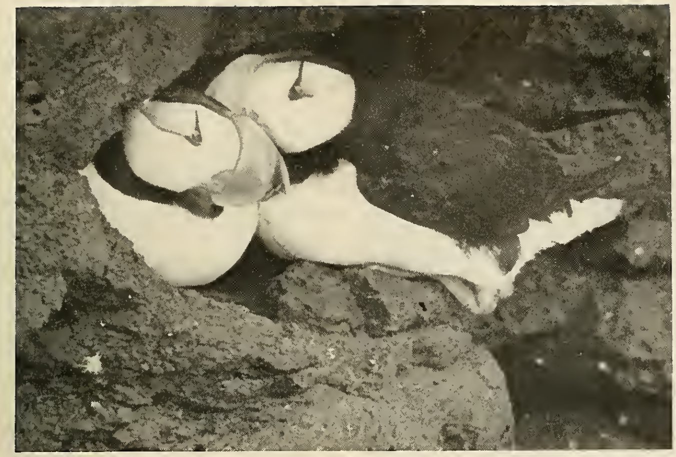
fins were often about the ship as she plowed doggedly through the tossing seas toward the north. Half a dozen glaucous-winged gulls had followed us from Unalaska, in the Aleutians, and an occasional kittiwake passed at a distance, ignoring and aloof. Least auklets and crested and paroquet auklets sometimes took wing, more lightly than the heavy puffins, or hurriedly dived as our bow broke water near them.

Puffins are frequently noticed by sailors because of their heavy, strikingly-colored bill and relatively large size (about that of a large pigeon). "I found one in a hole on a little island in the Aleutians where we stopped a couple of summers back," the quartermaster continued, "and when I put my hand in to grab him, he grabbed me instead." He held up his right index finger to display a long white scar line just below the fingernail. "I bled like a stuck pig and haven't bothered sea parrots since." Unlike the bills of hawks and owls, which are relatively weak, the bills of such fish-eating birds as the puffin are strong grasping devices.

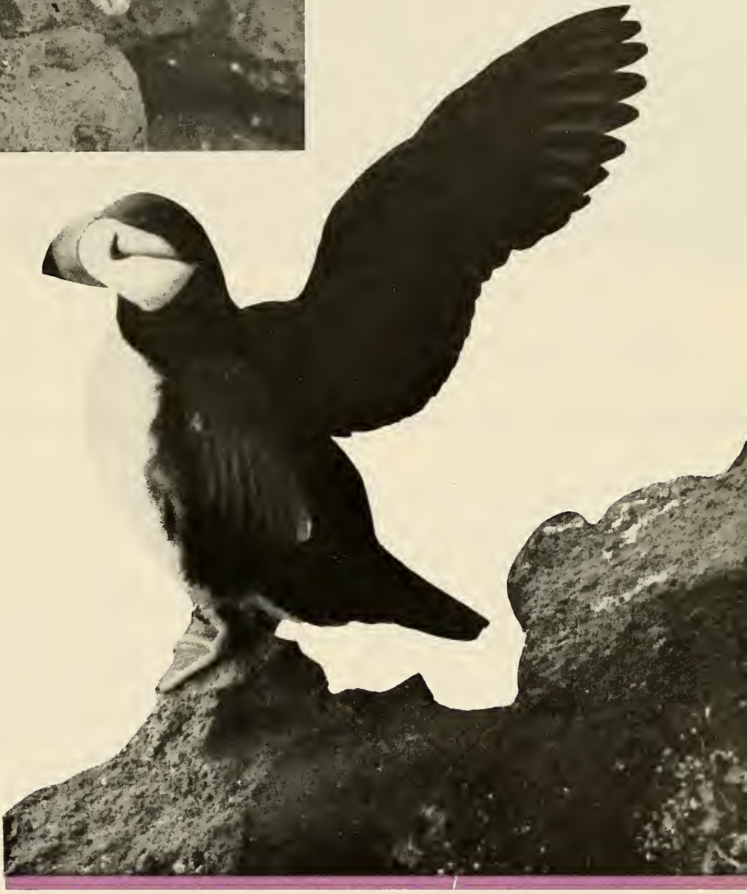
Later in the spring I had an opportunity to dig a puffin from its burrow and, remembering the sailor's experience, wore a pair of heavy gloves. The burrow was about four feet deep. About halfway to the enlarged chamber, where the single egg rested, it turned rather sharply to the left. When I had reached this point, the puffin decided to make a dash for freedom. As I grasped the escaping bird, I found that I had been wise to heed the sailor's misfortune. Even through heavy gloves the strong, sharp cutting edges of the puffin's bill dealt me several hearty pinches. Puffins are well aware of the power and effectiveness of their bills and when handled make every effort to use them.

Besides acting as a useful weapon of defense, the bill is employed in the excavation of the burrows in which these birds nest, and its razor-sharp edges serve well in their fishing activities. The brilliant colors of the bill are part of the puffin's nuptial adornment. Both sexes are marked alike, and during the breeding season the bill of the tufted puffin is largely a brilliant red-orange, with a pale waxy-green area at its base. That of the horned puffin is a pale lemon-yellow, tipped with shades of red. At the corners of the bill, a leaf-shaped wattle of flesh protrudes. This is crimson in the tufted puffin and yellow-orange in the horned.

After the breeding season has



< A PAIR of horned puffins carry on their courtship at the entrance to their summer home in a basaltic Pribilof cliff. The birds sit for hours on such perches, caressing each other with their bills



∨ THIS HORNED PUFFIN stands posed for a few seconds to stretch its wings before gliding away into the strong sea breeze that sweeps up over the face of the cliff

passed, the puffins lose their spectacular bills. In the late fall, the bill plates begin to loosen at the edges and scale off. The new bill, which is revealed as the sheath of the old one falls away, is smaller and duller in color. The bill plates are shed at the time of the postnuptial molt, when the tufted puffin also loses its streaming breeding plumes and retains only a few little white wisps behind the eye for the modest adornment of its winter dress. The white face, too, disappears and is replaced by dark feathers, so that as winter approaches, the adults take on much the same appearance as the young birds during their first winter.

Puffins range far at sea during the winter months and seem at home on the high seas even during the stormiest weather; yet they appear equally contented when they gather on wind-swept island cliffs during the summer nesting season. They begin to arrive in May, and you see numbers of them flying along the cliff edges or resting on the rocky projections and ledges to carry on their courtship. When a human intruder visits their nesting cliffs, their curiosity is aroused and they circle close by time after time, retarding the speed of their flight as they glide in on the strong upwelling wind that sweeps from the sea and rises abruptly against the face of the cliff. With necks stretched and orange feet spread to steady them, they stare inquisitively for a few seconds and are then off again for another circle. In the early spring the Aleuts take advantage of the natural curiosity of the puffins, as they do of the smaller auklets, by catching them for food in long-handled nets or by knocking them from the air with sticks.

Wild creatures must face many tests of their fitness to their environment. Thus, when we find a defective individual that survives these hardships, we cannot help wondering how he succeeded. In the summer of 1947, I found a tufted puffin handicapped by a blind eye. The bird was resting on

▲ PUFFINS SELDOM WAIT long enough to give a photographer a chance for a close-up like this one. Usually they launch themselves into the steady breeze, their bright orange feet spread as stabilizers while they gather speed. Then they circle back and take a close look at the human intruder

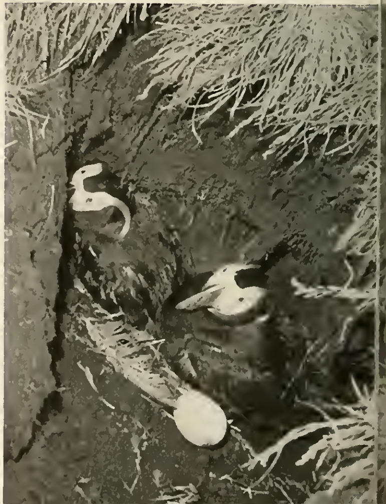
a rock that projected from the cliff, and from the edge of the cliff I could look down on him only a few feet away. Since his bad eye was turned toward me while he watched the circling birds near by, I was able to approach closely without frightening him. Apparently his eye had been injured by some accident or was affected by disease, since it was covered by a heavy, opaque membrane. To have found a one-eyed bird was not so strange. However, I was somewhat surprised when the following summer I found the same bird seated in precisely the same position on the same rock. He was undoubtedly a wise old bird that had weathered many seasons. He had the look of age about him. Although he seemed in good condition, his feathers were less sleek and glossy than those of near-by puffins, and he seemed a lonely fellow, apart from the others. I looked again for him last summer, but he failed to appear on his old perch. Apparently his blindness, coupled with old age, worked too strongly against him in the stormy winter of the northern seas.

For their nesting places puffins choose natural cavities in broken rocky cliffs or excavate a burrow in soft island topsoil. Although horned puffins prefer the faces of cliffs, the tufted ones often honeycomb loamy island slopes with their burrows. On such islands they dot the hillsides like tiny sentinels, sitting bolt upright near the entrances of their homes. Where foxes inhabit their nesting islands, as they do on many of the Aleutian and Pribilof Islands, both species are limited for safety's sake to cliffside nests. Aside from the labor of excavating, the puffins trouble themselves little over the details of nest building. The burrows that I have looked into contained only a careless scattering of grass stems or a few large feathers. Judging from the bedraggled appearance of these feathers, the birds must have found them floating on the surface of the sea. I have seen puffins returning to their nest holes from the sea with a primary feather of a gull held crosswise in the bill, in the same manner that they bring fish to their young.

The single egg is a lusterless white, faintly marked with varying amounts of pale brown and violet. It is large in proportion to the size of the bird, as are the eggs of other members of the auk family. The chicks hatch well covered with dull gray down, and their eyes are open and alert.

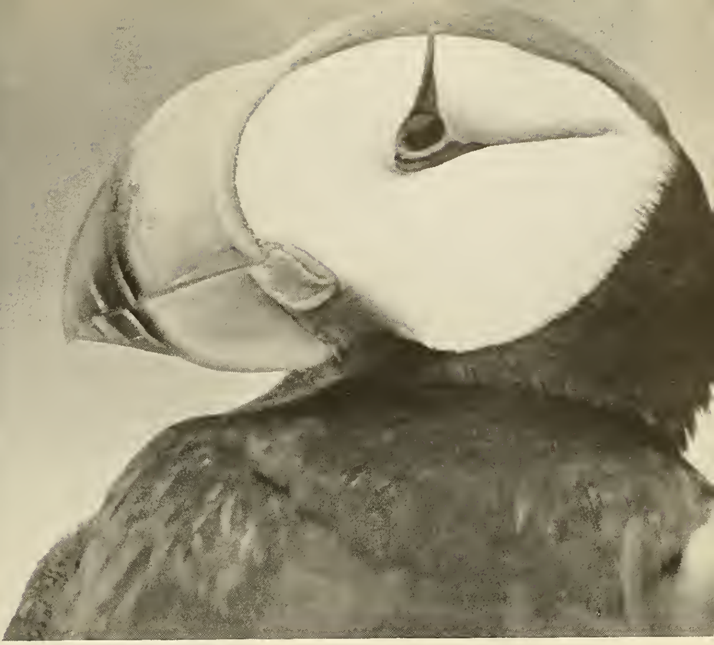
Puffin chicks make friendly and comical pets. They tame rapidly and are greedy eaters. The difficult part of securing a puffin chick for a pet on the Pribilofs is getting it from its nest. This is only possible through the use of a long rope and enough nerve to lower oneself down over a crumbling cliff edge. One afternoon I decided to make such a climb and found that locating a young puffin was one thing and extracting it from its hole in the rocks another. After looking into a number of deep and dark but empty crevices, I suddenly caught a glimpse of a ball of down well back in a dim recess. The little bird had no desire to leave its

▼ WITH THE AID of their strong bills, tufte puffins dig burrows in the soil three or fou feet deep. Where foxes and other predator animals do not force them to use the shee cliffs, the puffins honeycomb the topsoil c the islands with their underground home They lay a single lightly marked or nearl white egg

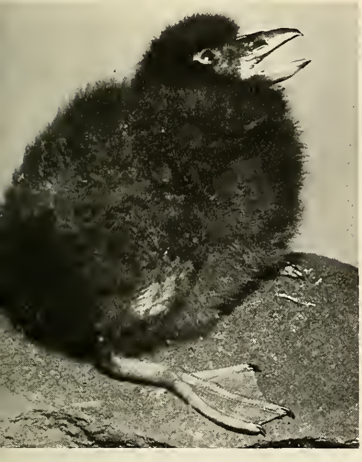


cozy quarters and scampered back to the darkest corner, where it turned a truculent, beady eye in my direction and refused to move. Since it was well beyond the reach of my arm, I shouted instructions to my helpers above, and a long-handled net came down over the cliff at the end of a line. With this I succeeded in introducing the young puffin to the light of day.

It proved to be a tufted puffin and once in hand appeared quite contented and interested—mainly in fingers, which it apparently mistook for tasty bits of fish. We found later that the young bird could consume at one sitting a handful of chopped fish equal to nearly half its own bulk. Even when full to capacity—to the extent that as it opened its bill to chirp for more, the last piece eaten threatened to escape—it seemed anxious to try to pack in still another morsel.



▲ THE SO-CALLED "HORN" of the horned puffin is really not a horny structure but a projection of erectile tissue attached to the upper eyelid. It is raised when the bird is alert. The large bill, besides acting as nuptial adornment and an effective instrument for catching small fish, proves useful in excavating the nesting burrow



▲ THE DARK SEPIA BILL of this young tufted puffin shows little resemblance to the massive orange one of its parents. Puffin chicks are gluttonous. This one continued to beg for fish scraps even after it was packed to the point of spilling over

On rare sunny Pribilof afternoons when I found myself free of other work, Lavrenty Stepetin, an Aleut boy interested in my work with birds, would help me round up my equipment, and we would go out along the cliff tops to locate photographic subjects. Lavrenty has spent most of his life on St. Paul, largest island in the Pribilof group, and was always a welcome assistant on such field trips. On these sunny afternoons we found the sociable puffins relaxing on the rocky projections of the cliffs near their nest holes. They enjoy the company of their neighbors and sit for long periods watching the host of murres and kittiwakes streaming back and forth between the cliffs and fishing grounds. It would not seem a difficult task to locate these resting birds, then lean out to take a photograph. However, the puffins are often quite wary of human visitors and usually glide away toward the sea, preferring to circle back to take in the situation from an aerial vantage point. Thus it was usually necessary to stalk carefully through the tall rye grass at the cliff edges, and Lavrenty proved a very able helper in securing the photographs accompanying this article.

In late September and October, most of the murres and small auklets have led their young away to the sea before the puffins leave their nesting cliffs. Not until harsh storms are lashing the Pribilof cliffs with a fury of wind and wave do the hardy puffins sever ties with their summer home and go to the open sea for six or seven months.

Snowflakes swirled about us as the "Penguin" turned her bow away from the Pribilofs and headed toward Seattle.

"Where do all the sea parrots go in the winter?" asked the sailor who had told us of his experiences with the birds a few months earlier. A drab brown bird paddled hurriedly away from our starboard bow, and I pointed it out to him. "Well, I'll be darned. I've heard of birds losing their bright feathers come winter, but this is the first time I've ever heard of a bird changing its bill, too. I wonder if they bite as hard with that little winter bill as they do with the big summer one," he mused.

▲ VISITORS TO Hancock Park look at the stagnant pond that was a death trap for great numbers of prehistoric animals

TAR

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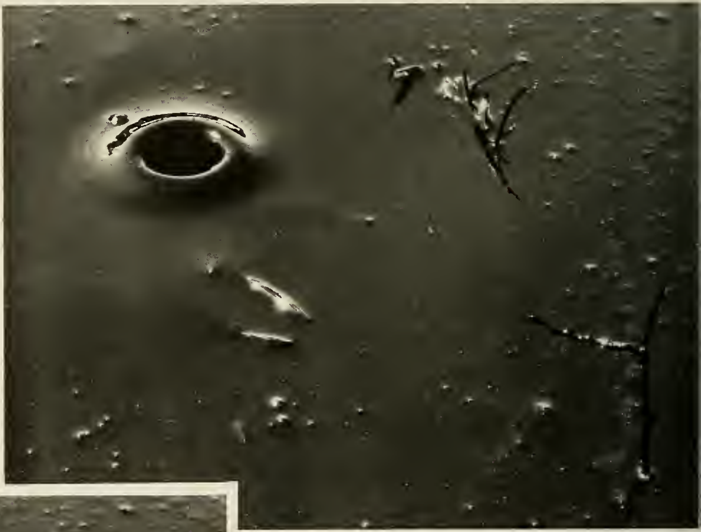
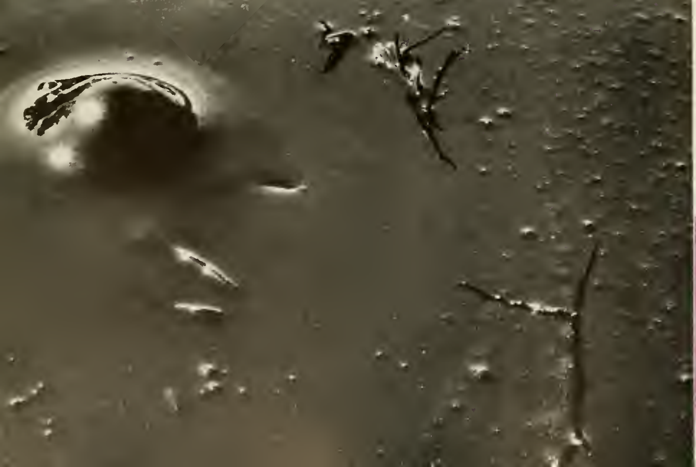
By BLAC

All photo

▼ OIL SEEPS continuously from the tar (bottom of picture) and flows out in streaks across the surface of the water



▲ THE BUBBLE has burst, and the surface is flatttening out



◄ A BUBBLE rising in the soft tar reaches the surface. The twigs have been trapped in the tar

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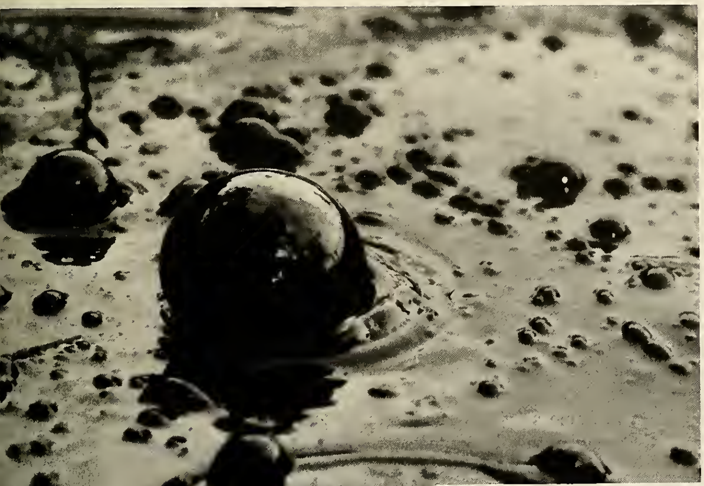
Amid the ultrasophistication of the twentieth century, scenes of 50,000 years ago depict the animal life of a vanished era at the world-famous tar pits in Los Angeles

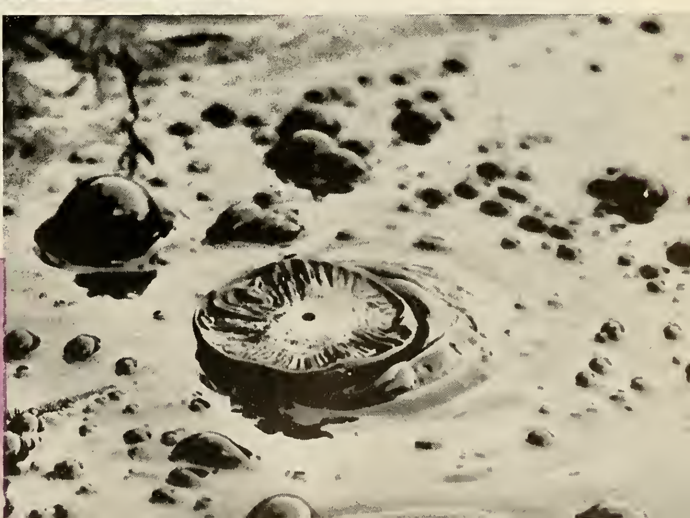
NOT all the strange goings-on in Los Angeles are of human origin. In one of the city's blocks the earth itself acts bewitched, or at least pixilated. Tar and oil continually seep from below the surface in a weird display of bulges, bubbles, streaks, and slicks. The place is called La Brea—Spanish for "the tar." The block is surrounded by stores, office buildings, and apartment houses but is itself kept as a public park—Hancock Park—not only because of the strange attributes already mentioned but also because of what has been—and in the future still may be—excavated from its tar.

For, back in prehistoric times, animals (many of them species now extinct) wallowed in the tar, got stuck, and died there. The flesh decayed, but the bones remained. Scientists have already dug up great quantities of them. Complete skeletons have been assembled and are on display at the Los Angeles County Museum. Under the direction of Dr. Chester Stock, who is the museum's Director of Science, Mr. George Kanakoff is soon to start digging again, seeking more bones and more knowledge. The new excavation is to be left open as a permanent exhibit that will show the public how the bones are found.

The fossils already obtained make up a unique collection, famous among geologists, for they comprise the world's largest assemblage of vertebrate Pleistocene animals. Yet many people who live near La Brea know little or nothing about this amazing place. It has not yet been subjected to much modern im-



F THIS MASS of bubbles, the most con-
ous one is growing rapidly. It reflects
ky and the surrounding trees and fence



➤ THROUGH THE HOLE in the center the bubble has burst, and its shell, which apparently had become somewhat hardened, has collapsed

Mural by Charles R. Knight in the American Museum, AMNH photo

▲ A MASS OF BONES exhibited in the jumbled fashion in which they were found when excavated

provement. The ground is uneven and dotted with scattered, uncultivated plants and with a few ponds of stagnant water. They look much like any stagnant ponds, but on close inspection you can see the tar and gas coming up through the water and along the shores.

Occasionally a sound of loud bubbling will attract the attention. It is gas escaping suddenly from below the pond, leaving small water bubbles on the surface and starting concentric circles dancing across it. In the same spot, tar is coming up. It comes in shafts or ribbons, fairly vertical until they reach the surface, where they float and weave like weathervanes as the water current (the slight, vacillating, wind-caused current of a stagnant pond) may turn them. Purplish, oily scum floats off from the tar and across the pond.

Around the edge of the pond there is more tar. Much of it has hardened, but some of it is still fluid and active. It slowly rises in a small mound. The mound forms into a black bubble. There are other bubbles near it which have not changed noticeably in size. But this bubble grows larger and larger, keeps growing for a minute or two —and then suddenly it bursts. The others remain; this one has paid the price of ambition. The gas has escaped; the tar sinks back into a sort of small crater and quickly flattens out.

The oil and tar and gas originated in layers of rock that, even in Pleistocene times, were ancient and far below the surface. The earth pressed down upon the oil and tar and gas, which oozed out on the surface. During the Pleistocene period, the oil and tar formed large pools, some of them many square feet in area and extending to depths as great as 30 feet. The tar, exposed to the air, hardened, and soil has since blown or washed over most of it. But when it was exposed in large pools, many animals were caught in it. Some may have wandered that way purely by chance; others came to drink the water which, then as now, collected in the depressions of the soil. Dr. Stock has written, "It is not difficult to visualize some of these Pleistocene catastrophes. A single animal, large or small, becoming mired in the tar would as a result of its struggles and cries lure others to the trap. The carnivorous birds and mammals seeking to reach this bait would frequently fall victims to the tenacious grip of the viscous material and thus in turn would serve to attract still other creatures to the pool." Dr. Stock explains that the excavated fossils contained preponderant numbers of predatory forms and also many young, aged, and maimed individuals. Animals that couldn't take good care of themselves were at a special disadvantage at La Brea.

Although the tar now covers much smaller areas and is less active, it is still said to be a danger to small animals such as ground squirrels; indeed, the museum has on exhibition the body of a bird mired in the tar. But such tragedies are now rare. On several visits to La Brea, I did not find a sign of any animal caught in the tar, though leaves and twigs illustrated how creatures would stick and sink in it. The tarry depressions are now individually surrounded by high wire fences.

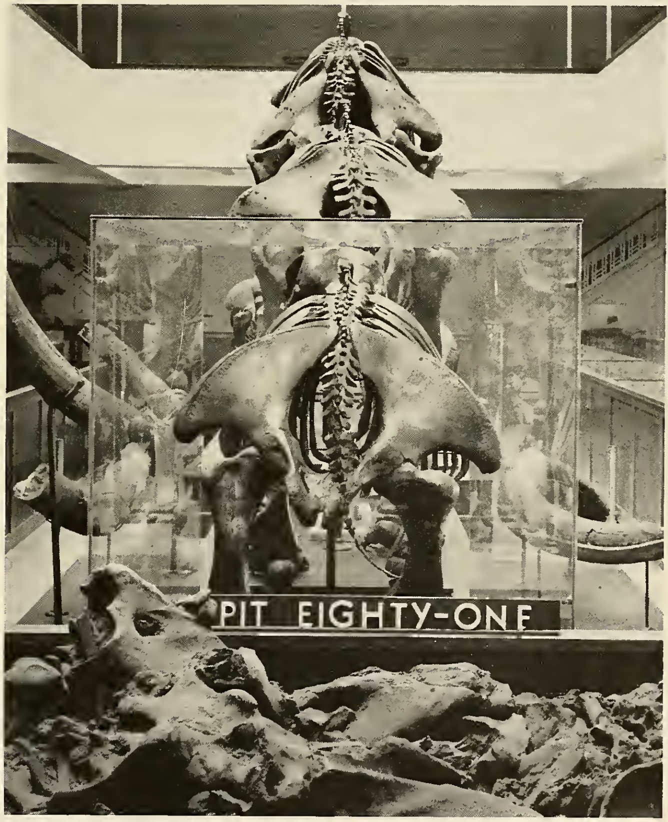
Though these depressions seem weirdly primeval, most of them are the work of man, being the holes left after excavation. Now man—in the person of the Los Angeles County Museum—is giving a face-lifting to the surrounding plain, at least to the block that the growing city has not already eaten up. He has felled trees and scraped the ground bare. He has erected concrete statues of Pleistocene animals and has built two modernistic comfort stations. He promises 55,000 square feet of paved walks, a complete lighting system, and stream and lagoon construction. He prom-

ises also "an elaborate landscaping scene to simulate as far as possible" the setting as it was when the ancient animals were trapped. This means more vegetation, for it is believed that the climate was not so dry then. Many types of trees and shrubs that lived here then are still found in other parts of California and can be made to grow here again by cultivation. Some time further in the future, a new museum is to be built in the park (the present museum is many blocks away), and the present statues are to be replaced with better ones.

Let us hope that the result will not look like just another city park, hiding the primeval burpings of the tar or inharmonious with them. Perhaps the skill of man, and a $738,400 project, are necessary to make a modern wilderness look like an ancient wilderness. Especially with paved walks and comfort stations. We must wait and see.

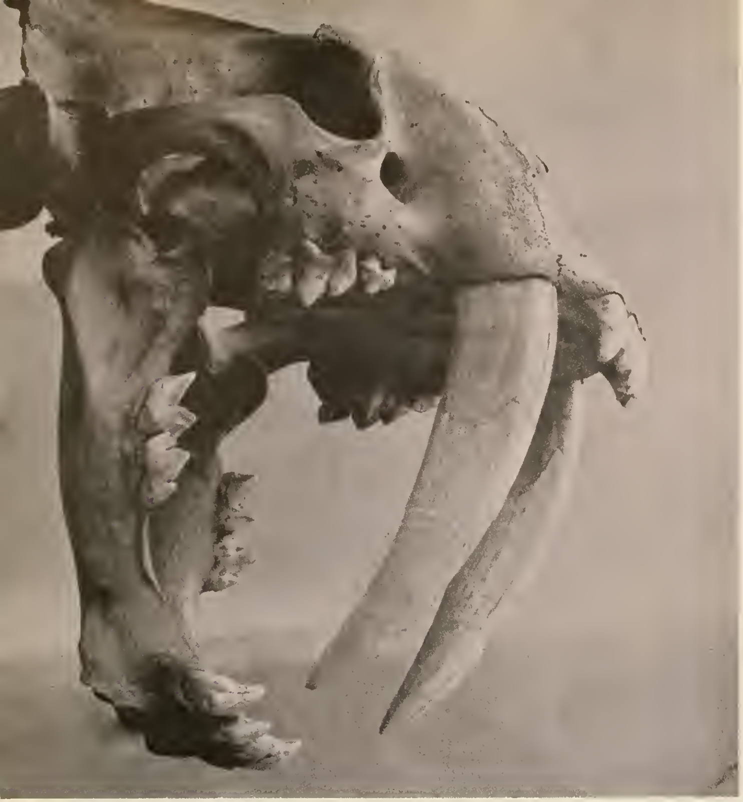
We can already see, in the museum exhibits, a sample of what the excavators dug up from the depths. They made such huge hauls that much of the material is not on display; there are boxes and boxes of bones stored in the basement, with one discarded skeleton perched eerily on top of them. More than 180 different kinds of animals and plants have been recovered. Of mammals alone, more than 4,000 individuals are represented in the museum's collection. When the excavators dug down into the tar to see what they could see, they found bones distributed quite irregularly. In some areas there would be few or none; in others there would be amazingly dense collections. One such jumble of bones is mounted as an exhibit in the museum.

Nature was kind to the scientists not only in the quantity of animals trapped at La Brea but also in the quality of preservation. Although the softer tissues disappeared, the harder parts remained intact. Limb bones retain many surface markings, indicating the courses of nerves and blood vessels and the places where tendons and ligaments were attached. Teeth show the wear their owners gave them. Some bones and teeth exhibit the effects of injury and disease; there are fractured bones that had healed. While the tar preserved the bones that sank within it, some did not sink until they had been gnawed on. In these cases, the marks of the gnawing were preserved—and the scientists can tell which were made by carnivores, which by rodents. Other bones remained exposed to the atmosphere for some time be-



< Hancock Hall, Los Angeles County Museum. Reconstructed in the foreground is a prehistoric elephant. The original tusks of this specimen were not recovered, but duplicates were fabricated. The painting in the background by the famous artist Charles R. Knight shows his conception of La Brea in Pleistocene days

^ As if arising from the confused bone-pile in the foreground, the skeleton of an immature mastodon ambles away. Ahead of it is a mature mastodon and beyond that an elephant



▲ HEAD of a saber-toothed cat. The lower jaw closed between the large canine teeth

fore sinking in the tar. They show the same effects of weathering as do modern bones lying on the western plains. In some cases there is another type of wear: the bone-laden tar apparently shifted so much that the bones were scratched.

Some of the bones are enormous. They came from enormous animals: the elephant skeleton mounted at the museum measures eleven feet, seven inches to the top of the skull, and the skull itself is nothing to toss lightly around. But the tar also preserved many small things for the painstaking scientists to recover. In some skulls, the tiny bones of the inner ear were intact. Seeds and cones and even leaves have been found; fragments of insects have been identified. The smallest exhibits in the museum's collection are mounted on microscope slides. Some of them may be hair. Miss Gretchen Sibley, a member of the staff who is working for her doctorate, is examining longitudinal and latitudinal cross sections as well as casts and molds, hoping to learn more about what the cautious scientists at present refer to as "material resembling hair."

Among La Brea mammals, flesh-eaters form a large majority. If they had occurred in the same proportions over a large territory, they just wouldn't have had enough flesh to eat. Of course, they came to the tar pits to feed—and stayed to die. Of these carnivores, most belong to the dog family (wolves, coyotes, and foxes) and the cat family. There are also a few bears and other forms.

Of the cats, the most frequent and the most amazing is the sabertooth. Its two dagger-like canine teeth make even a skeleton look ferocious. This animal was of about the size of an African lion. Unlike the lion, it was not fleet-footed but depended for its food on its ability to grapple and fight at close quarters. Not that any witness has described such a fight; the last of these creatures died before recorded history began. But scientists can deduce an animal's habits from the shape of its bones. Light hind limbs and strong front limbs indicate a fighter, not a runner. The rib basket and breastbone bear out the contention. And those teeth—well, here's how Dr. Stock reconstructs the past: "In attacking a large mammal like an elephant . . ., the saber-toothed cat would probably seek a vulnerable spot on the body or neck of its prey, grip the victim with its powerful front limbs and claws, and repeatedly stab with the upper canines, thus inflicting a jagged wound. In this attack the lower jaw was capable of swinging downward, giving a considerable gape to the mouth, the powerful head and neck muscles furnishing at the same time a strong thrust

▼ LEFT FRONT FOOT of a prehistoric elephant that once roamed near the heart of present-day Los Angeles

▲ All of its relatives have become extinct in North America since the day when this camel scanned the California landscape

◄ Head of a bison

which accompanied the stabbing action of the teeth. The backward position of the nasal opening presumably permitted the animal to breathe with head plunged deeply into the side of its victim . . ." Occasionally one or even both of the saber-like teeth would be broken. Their broken edges, now recovered from the tar, are worn smooth, showing that the cats continued using them after they were broken. The cheek teeth of such individuals also frequently show excessive wear, suggesting that the animal found greater need for them after the canines were damaged.

So much for the carnivores. The other mammals are fewer but in many cases larger. The elephant is largest—larger indeed than the elephants now living – and adorned with huge tusks. Next in size is the mastodon, whose tusks are small by comparison. There is also an extinct bison, larger than the modern North American buffalo and having, like it, a forward hump on its back and horns on its head. There is a horse, which evolution had brought to the size of the modern horse and to one-toed feet. However, it was of a different species than horses now living; horses, like elephants, became extinct in America before the coming of the white man. Camels also became extinct on this continent, but one species is represented at La Brea. It presents a problem the scientists haven't been able to solve. They've reconstructed the skeleton of an entire camel—two, indeed—but the bones give no indication of whether or not the animal had a hump or humps. For, unlike the skeleton of a bison, the skeleton of a camel does not extend up into its hump.

Three of the other skeletons are of ground sloths. One is mounted erect on its hind feet and heavy tail. This isn't due to somebody's whim or an offhand guess. This time the bones did tell a story. The pelvis has a shelflike projection over the hip socket to support the weight of the erect body. The tail bones show that the tail was large, so that the sloth could use it for support and balance, as a kangaroo does. This is the paramylodon, or giant ground sloth. Beside it is another of the same species, this one mounted on all fours, showing how the animal looked when walking. Ahead of the two paramylodons is a nothrotherium, the smaller ground sloth. It is also on all fours, because it had a weaker tail and no projection over the hip socket and presumably could not stand erect.

Birds of about 115 different types have been recognized in the La Brea material. They are a rare find for paleontologists, since the delicate bones of birds are not preserved except under most favorable conditions. There are many predatory and scavenger types, presumably attracted by the animals trapped in the tar. There are also a few aquatic birds, presumably attracted by standing water. The birds vary greatly in size. Teratornis, an extinct vulture, is recognized as the largest known bird of flight; it stood two and a half feet high and had a wingspread of at least twelve feet.

Don't ask about dinosaurs, just because La Brea is full of fossils.

◄ Visitors view the skeleton of an elephant. Below it is a plaster model of the same species as it probably looked in life

▼ School children are awed by these giant specimens, as Miss Gretchen Sibley, museum lecturer, describes their interesting characteristics

La Brea animals lived in the Pleistocene period—and that's not very long ago, geologically speaking. Dr. Stock's latest opinion is that the animals were trapped in the tar from about 60,000 to about 40,000 years ago. And the dinosaurs all died long, long before that.

Various parts of plants have been recovered and identified, wood being the most common. An unusual find was the upright trunk of a conifer. It was eight feet high (above that it had burned or rotted away) and was rooted in the clay, twelve feet below the present ground level. The trunk was surrounded by clay, sand, and asphalt and by a dense mass of bones and skulls, all of which had obviously inundated it where it grew.

During the excavations, a human skull and a few other human bones were found. They were close together and clearly belonged to one individual. The construction of the bones indicated it was a woman. The shape of the skull, with high cheekbones, mark her as an American Indian—a modern type, from a geologist's point of view. The other animals represented in the same excavation indicate also that nature operated this particular booby trap in the geologic "Recent," not, like most of the pits, in the Pleistocene. The woman may have lived thousands of years ago, but not tens of thousands.

A few indications of man's presence were found in the other and more ancient excavations, including parts of atlatl darts. So perhaps human beings of some sort were around to see the ancient animals wallow and die; but if any of the Pleistocene people were careless enough to get stuck, the fact is still a secret of the tar.

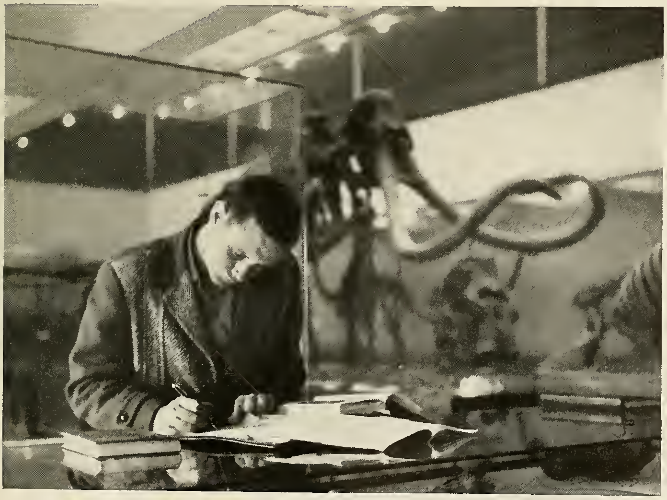
But what of modern times? How was this natural phenomenon discovered? In 1769, Gaspar de Portola saw "extensive swamps of bitumen," and debated "whether this substance, which flows melted from underneath the earth, could occasion so many earthquakes." In 1792, Jose Longinos Martinez wrote of the "great lake of pitch" in which animals had been seen to sink. He said that trapped animals were a source of game for the Indians and that bones of animals lost in the tar came up years later. In the 1860's, '70's, and '80's, the tar was dug up for use as roofing, paving, and fuel. The diggers came across many bones but tossed them aside in disgust, especially when the quantity made further commercial use of the tar impractical.

Along about 1905, scientists became interested. They've been digging off and on since and have made 100 or so excavations in various parts of that city block. Sometimes they didn't even find bones. Sometimes they did, and kept finding them as much as 50 feet below the surface. When they were through digging, they usually filled up the hole again. In a few cases, they did not fill it up all the way but left the depressions where the action of the tar may now be seen.

Well, after they'd dug something up, what did they have? A mess. A tarry mess. First thing was to get rid of the tar. So they immersed lumps of the material in vats of heated kerosene, supporting the lumps on a three-quarter inch mesh screen. Thus they removed and cleaned the large bones. Until recently, anything small enough to fall through the screen was lost—thrown out with the tar in a refuse dump. But the dump was preserved; and in 1947, Dr. W. Dwight Pierce and Mr. Kanakoff began recovering the small pieces by means of a Soxhlet apparatus, which held the tarry material in a filter cup. Hot benzine dripped over it, removed the tar, and was siphoned off. The objects that remained, many of them very small, were sifted through a series of screens, sorted, resorted, and studied.

As you may have gathered, the experts are quite clever at identifying the various parts. There are even specialists for different types of material. The late Dr. Roy L. Moodie has written about the ancient evidences of disease among the La Brea specimens. The late Dr. John C. Merriam and Dr. Stock brought La Brea its scientific fame through a book about the great cats. Dr. Alden Miller, Dr. Loye Miller, and Dr. Hildegard Howard have written books about La Brea's birds. Dr. Ralph W. Chaney is still working on the plant material.

When enough bones of one kind of animal are assembled, they may be set up as a complete skeleton. Most of this work has been done by Mr. Eugene Fisher, recently retired. In some cases, the bones of one individual animal were found close together in the tar; indeed, the museum has not only an adult mastodon skeleton but a young one trailing right behind it. If there are a few bones missing, the scientists make artificial replacements, which blend unobtrusively with the genuine parts but do not deceive a careful, trained observer. If there's a bone left over—well, as yet the museum personnel has resisted a strong temptation to give one of the skeletons an extra bone to carry between its jaws.


⮝ **Boning up on bones**: one of the many twentieth-century students who frequent Hancock Hall to take notes

Hancock Hall, which contains the tar-pit exhibits, is large enough to give them space to be seen. Museums nowadays know something about effective display. The huge skeletons march behind each other like some fantastic circus parade. They are dark brown, since no amount of cleaning can remove the stain of the tar, which has penetrated the hardest layers of bones and teeth. The skeletons are silhouetted against a plain, light-toned wall.

The place is open to the public, of course, and people of all sorts wander through for a look. Almost any morning of a school day, two or three classes of children will have sessions with the fossils. Their regular teachers come along too, but the museum supplies its own speakers. Occasionally a group of older students will spend a few hours of research in the room, reading, peering at the bones, and scribbling in their notebooks.

Out at La Brea, the tar still bubbles, and the construction gangs go on working. Perhaps they can bring back the wilderness. We may hope at least that the museum will use its knowledge of display to show the public the origins of the fossils as tastefully as it shows the reconstructed skeletons. We may hope that Dr. Stock's effort to transplant trees and shrubs such as grew there in the Ice Age will serve to hide the comfort stations. We may wish Mr. Kanakoff luck when he starts digging again. The workmen have built him a house to dig under; when he's through digging, the new excavation is to be preserved there as a permanent exhibit. A test boring has told him there are some bones to be found in the spot selected. Let's hope he will have a rich harvest.

HOW A
Rattlesnake Strikes

The superspeed camera shows how the snake spears its victim with its venomous fangs

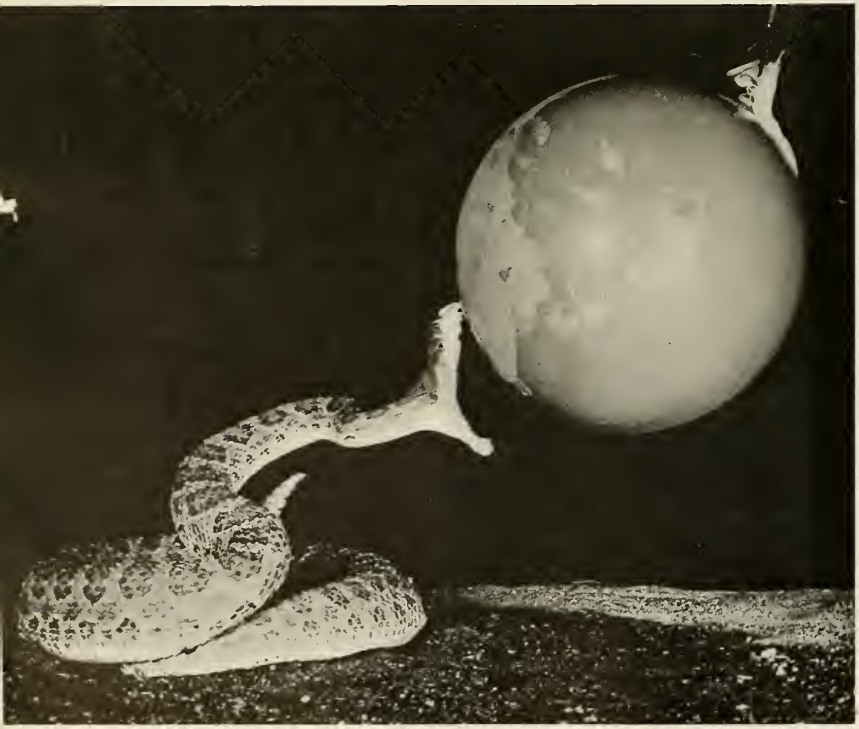
By Walker Van Riper
Denver Museum of Natural History

Photographs by the author

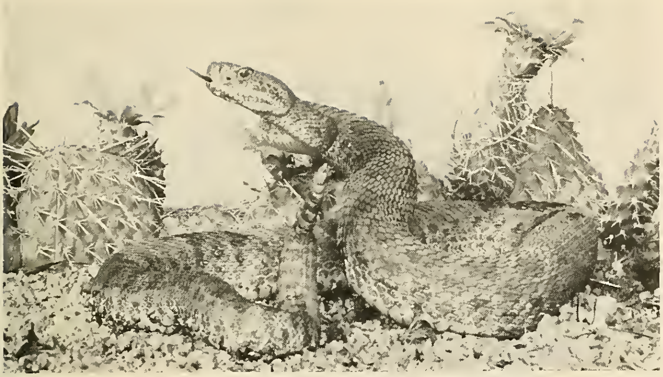
THAT the strike of the rattlesnake culminates in a stab rather than a bite is shown in the accompanying pictures. The venom-injecting apparatus of this reptile consists of two long and hollow teeth, the fangs, which are provided with holes near the point for discharge of the venom and are connected in the rear with venom glands and muscles that force the venom outward. The fangs are, in fact, the exact counterparts of hypodermic needles.

At rest, the fangs lie back against the upper jaw, almost parallel to the floor of the mouth, and are covered with a white membranous sheath. When the mouth is opened wide for a strike, the upper jawbone is rotated through nearly a 90-degree angle. The fangs are, at the same time, raised so that they point forward at the moment of impact. Only the points show, because the rest of the fangs are covered by the white cone-shaped sheaths. The photographs show how extremely wide the jaws are opened and that they remain wide open until the withdrawal movement is well under way. The snake shown is the Prairie Rattlesnake, *Crotalus viridis viridis.*

These pictures of the strike were taken with the high-speed electric flash invented by Dr. Harold E. Edgerton of M.I.T. Exposures are on the order of 1/10,000 of a second. Small rubber target balloons were employed in such a way as to trigger the flash at three different points during the strike. To get the flash at the exact moment of impact, the surface of the balloon was made conductive by dipping it in a warm salt solution, and the wire on which the balloon hung was



◄ At the moment of contact, th jaws are spread wide and the fang brought forward so that thei points stab the target

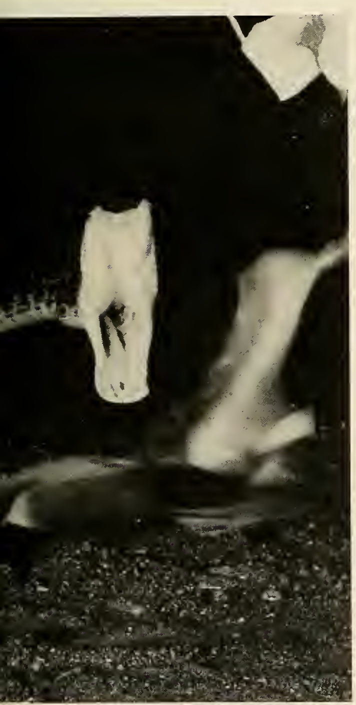


▲ The tongue projecting from the mouth of the Prairie Rattler in this exhibit is a sensory organ, not part of the venom-injecting apparatus

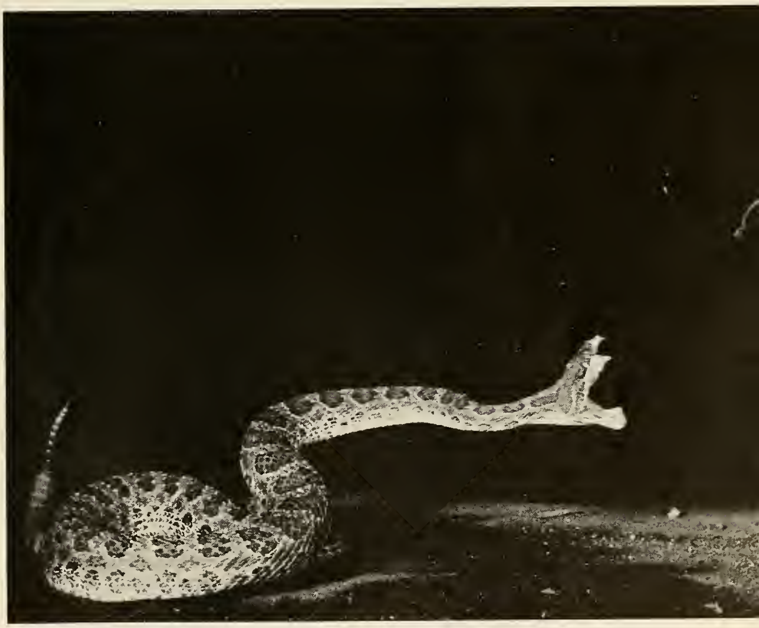
connected to one side of the trigger switch controlling the flash. The snake was placed on a pad of damp earth over a square of hardware cloth which was connected to the other side of the switch. Thus the first bare contact between the striking fangs and the balloon fired the flash.

To show the position of jaws and fangs at the moment the balloon burst, the switch points were fastened close together on the surface of the balloon in such a way that they would come into contact when the balloon collapsed. To get the action an instant later, with the withdrawal movement under way and the mouth closing, the switch points were handled in the same way but placed a little farther apart.

The withdrawal picture, which shows the return movement half completed while small pieces of the balloon are still in the air, gives some indication of the speed of the strike. It is incredibly fast. The first picture of the snake shows the long, black, forked tongue flicking out. This is often thought to be some sort of stinger, though in fact it is a highly useful sensory organ. What happens to the tongue when the snake strikes can be seen in the head-on picture, which shows the jaws wide open after the balloon has burst. The tongue is withdrawn into a protective sheath in the floor of the mouth. The black hole at the lower end of the lower jaw is the opening of this sheath.



▲ Head-on view at instant of collapse of balloon. Note small black hole near front of lower jaw, into which the tongue has disappeared



▲ Withdrawal after striking the target

How Dangerous ar

Hair-raising stories are written about the ferociousness of the tiger, the lion, and the bear, but the most dangerous animal of all may be lurking in your own cellar

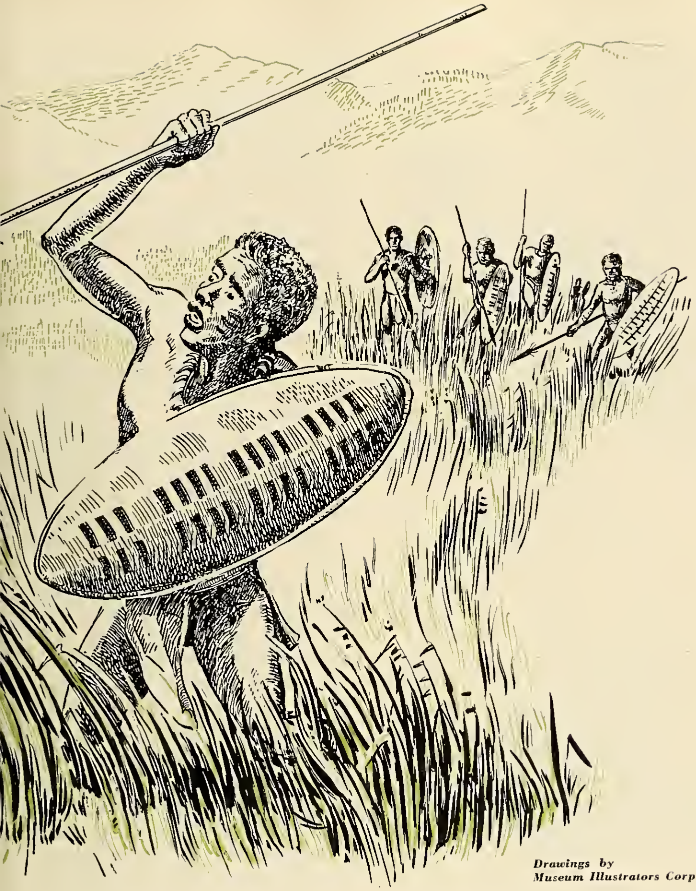
By George G. Goodwin

Associate Curator, Department of Mammals, American Museum of Natural History

MOST animals of any size are dangerous to man, but fortunately for him they do not know it. Man has the advantage over the beasts of the field only in that he has armed himself with artificial weapons and protection. With few exceptions, animals are not aggressive toward man; the danger lies in their attempt to protect themselves from man.

As a protective measure a comparatively few species exercise collective armed might. The peccary is credited with combining forces to attack an aggressor, and a band of musk oxen will join together in a circle to protect all sides of their group from the onslaught of wolves, bears, or dogs. Honeybees and many of the social wasps will frequently attack in mass when someone threatens the safety of their nest. A stampeding herd of large animals is dangerous to anyone caught in its path, but the animals are fleeing from danger, not attacking.

Most animals and birds will fight to protect their young. The large carnivorous animals such as the big cats and bears are especially dangerous when they have cubs or kittens. Hawks will stoop at anyone climbing up to their eyries, and a goshawk will plough right in and severely claw anyone who gets too close to its young.



◂ MAN-EATING LIONS represent but a small percentage of the lion population. Most lions will run at the sight of man

Drawings by Museum Illustrators Corps

Animals?

All through the ages, man has been afraid of the dark and the unknown. Everyone has heard the legends of vampires—batlike creatures that are supposed to suck your blood under cover of darkness. These legends are of Old World origin, which is strange in light of the fact that the only bats that actually subsist on blood are restricted to tropical America. The true vampires lacerate the arteries of human beings while they sleep and lap up the flow of blood, but they are comparatively small bats, and the loss of blood is not serious.

Animals have entered many fields of protective and aggressive warfare. The most effective and useful weapon is usually found in the mouth. Many insects have horny cutters encasing the mouth and can inflict terrific punishment for their size. Most mammals will fight their way to freedom with their teeth. But some, such as the rabbits, will not bite no matter how badly they are treated; and a few, such as the anteaters, do not have teeth.

The cats have the most highly specialized teeth for attacking, but the dogs have the strongest jaws. Tusks, such as those of the elephant, walrus, wild boar, etc., are used primarily for obtaining food, but they make effective weapons none the less. Teeth are practically useless without a strong jaw to drive them in and the power to hold. The snakes are an exception; their needle-sharp teeth are directed backward in the mouth so that the victim is virtually hooked – the harder he tries to escape, the deeper the teeth penetrate. The poisonous snakes inject their venomous fluid through their long hollow fangs, and a struggling victim only increases the dose of venom. This death-dealing serum is only injurious when it enters the blood stream. The snake can eat its victim without ill effect.

Tarantulas, black widow spiders, and the like have poison sacs in the mouth and are able to inject their venom into a wound. Scorpions, bees, and wasps inject their poison by means of a fine horny stinger situated at the hind end of the body.

The mammals have entered the field of chemical warfare. Most animals of the weasel family have anal glands specialized for ejecting a disagreeable and irritating fluid. The skunks have carried this specialization to the extreme. They can eject their obnoxious fluid in the form of a fine spray and can hit a target eight or nine feet away with remarkable accuracy. The charge is usually directed at the face of the aggressor and is most effective when it comes in contact with the eyes, nose, and mouth. The bite of some shrews has a mild toxic effect but is harmless to anything larger than a mouse.

Nails, in the form of claws and hoofs, are effective weapons. Cats have especially sharp claws, which, when not in use, are retracted and kept in a sheath to guard their fine points. Most hoofed animals will fight with their sharp forefeet. Horses kick and are very adept at whirling around and dealing a broadside with both heels simultaneously. When cornered, a kangaroo can defend itself from a whole pack of hounds by means of a great claw on its hind foot. It will rip to ribbons any individual within its grasp.

Deer, oxen, sheep, and goats do not have upper teeth in the front of the mouth and cannot bite, but they have horns or antlers—in the male if not in both sexes. Horses, asses, and zebras, on the other hand, which have teeth in the front of both upper and lower jaws and therefore can and do bite, do not have horns or antlers. There is no doubt that in a head-on charge the antlers of the moose or elk present a more formidable front than the horns of a bison, but the antlers are only serviceable for about four months of the year, and only the male has them, except among reindeer or caribou. Horns, as distinct from antlers, are permanent appendages and are usually possessed by both sexes.

Dogs fight only with their teeth, but cats use claws as well. A bear goes one step further and crushes its victim with its arms. A grizzly can break the neck of an ox with one blow of its mighty paw. A big boa constrictor or python will strangle its victim by wrapping its body around it and contracting the coils. One of the large boas can crush a pig or small deer to pulp and swallow it whole.

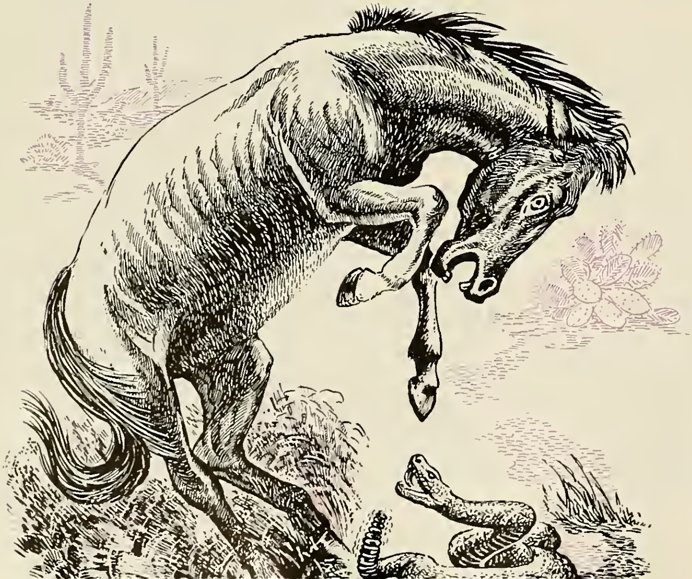
Most of the people who have accidents with animals are careless or inexperienced hunters. A few persons get badly mauled by wounded animals, but most of the deaths occur when a hunter mistakes another person for an animal.

With the reduction of working hours and more time for leisure, there is a marked tendency for the average American to go farther afield for his recreation. Extended vacation periods and swift transportation bring the quiet and peace of many great wildlife reservations within the reach of almost every citizen, and even central Africa is less than two days away from New York by plane.

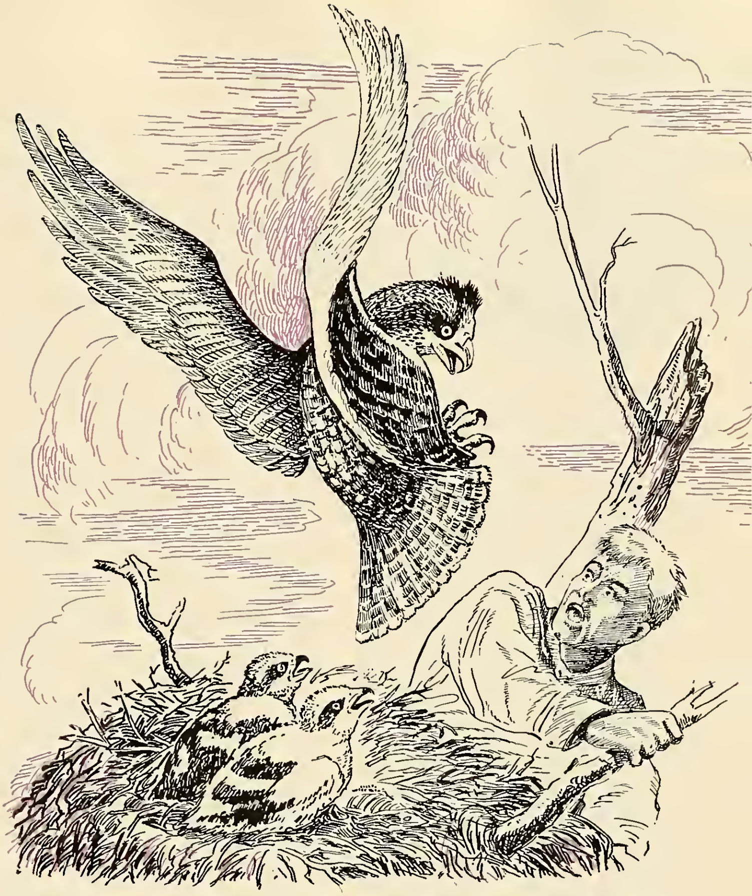
It is only natural that during these times of insecurity and unrest man should be instinctively drawn back to the cradle that raised him. Gone are the great herds of game from most of the world. Waving corn now sweeps over plains and prairies where once roamed the antelope and bison. An air of lonely silence hangs over the lofty mountain crags, the deep green woods, the still blue lakes. Occasionally a bear ambles out of the forest gloom, and the deer browse in remote woodland glades. These remnants of America's once great wildlife are forever on the alert, not so much for a natural foe but because they fear the presence of man. Even the scent of human beings borne on the breezes will send these creatures scurrying to safety. Most wild animals, great and small, have acquired a sincere respect for man. Even the grizzly bear, once America's most formidable creature of the wild, has learned to shun the hunter with his firearms. There was a time when all stepped aside for the grizzly; none disputed his lordly right. Today we are virtually safe from attack by *all* wild creatures, providing they are not provoked and we use reasonable discretion. Normally all the mighty beasts of the field flee at sight of man. In fact, unspoiled wild animals are much safer and more trustworthy than the domesticated creatures.

I do not know of a single authentic case in which a pack of American wolves has actually attacked a human being, and it is not improbable that most, if not all, of the tales of ferocious Russian wolves were based to a large extent on folklore and hearsay. Yet only recently, a pack of well-trained and cared-for bull terriers murderously attacked and killed a child for no apparent reason except perhaps out of sheer lust to kill. Everyone is familiar with the treacherous nature of the domestic bull. Many a farmer has been gored to death by a prize bull. Unprovoked attack cannot be charged in the same way against the wild bison.

It is true that every once in a while someone does get hurt by a wild animal. As might be expected, the public rises in wrathful indignation, demanding the creature's death. A life for a life may be poetic justice, but it is not fair to condemn a whole race because of the misdeed of one individual that has dared to attack man, the most ruthless of all killers. It was indeed a horrible tragedy when a black bear killed a three-year-old child in Michigan not long ago. Such a disaster naturally stirs deep



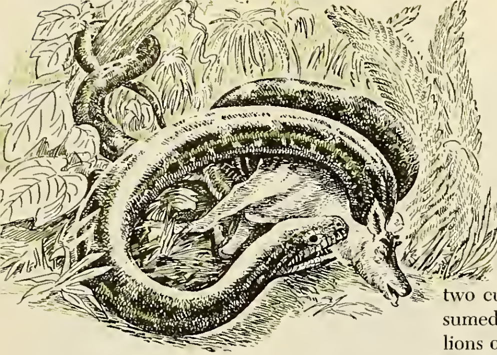
◂ RATTLESNAKES are one of our most dreaded creatures. Horses as well as deer kill them on sight public feeling. Seemingly, there was no one to take the blame except the bear, and the chances are that the bear was not a really bad bear. At least, there was not sufficient evidence to accuse it of willful, premeditated murder. No criticism could be directed at the child's mother; she was used to seeing black bears around the house and to chasing the animals away with nothing more formidable than a broom. She was justified in her assumption that an untamed black bear would not attack without provocation. The animal is not a habitual meat eater but subsists principally on berries, nuts, roots, insects, and mice. Actual details of what happened, if they were available, might offer some explanation of this strange behavior. The child may have been eating candy and, as children are apt to do, smeared a liberal coating of sugar on her hands and face. The bear, being exceedingly partial to sweetmeats, may have carried the child off primarily for the sugar. Explanation will not bring back the child or soften the anguish of the parents. But somewhere along the line, human intervention had grievously erred in dealing with this particular bear.



▲ Most animals and birds, like the osprey shown here, will fight to protect their young, but man is the aggressor

Where man's respect for the mighty beast of the field has waned, trouble must follow sooner or later. Wild creatures may temporarily be subjugated to the human will, and they may seem unresentful or even grateful for a hand-out of choice food, but under such circumstances they cannot be trusted unconditionally. As soon as their desires are frustrated and their respect for man has been dispelled, anything can happen. It is not only the bear that will turn and attack the hand that feeds it. A buck, hand-raised from a fawn and bottle-fed, may be a most exemplary pet during its tender years, but on reaching maturity it may suddenly and without provocation or warning turn on its master and attack. It should be remembered that when cornered or suddenly confronted with danger, and especially when wounded, any wild animal is apt to charge. This is not a treacherous attempt to kill but an act of self-preservation. A rhinoceros will almost always charge when surprised at close quarters, but given a reasonable warning it will put as much distance as it can between itself and the intruder. African buffaloes and elephants are among the most dangerous animals to hunt, not because of any resentment they may bear toward man but because when wounded or cornered they have courage enough to charge in an attempt to save their own lives. Rogue elephants and elephants "in must" are an exception, although even here it is a mental disorder or expulsion from the herd that makes them dangerous. On the other hand, the elephant is one of the few wild animals that can be trusted when domesticated. In fact, as Mr. W. A. Bevan, a wild animal collector, aptly puts it, "Elephants are grand people." Madge Bellamy tells of an incident where the quick thinking of a trained elephant averted a tragedy. It seems that in her act an elephant was supposed to make the pretense of kneeling on Miss Bellamy. On one occasion the posture was prolonged a fraction too long for the muscles of the poor beast. Being unable to support itself longer, it began to sink lower, thus increasing the pressure on Miss Bellamy. Apparently realizing that it was hurting her and would soon crush her, the elephant wrapped its trunk around Miss Bellamy and pulled her to safety, at the same time dropping on its knees with a crash.

Man-eating tigers and lions are usually elderly individuals that



◄ A PYTHON takes a strangle hold on a deer, crushing it by contracting the coils of its body and anchoring its tail on a nearby tree

have lost most of their teeth and are no longer competent to catch wild game for themselves. But this is not always the case. With the exception of full-grown elephants, rhinoceroses, and hippopotamuses, there is no creature in Africa safe from attack by lions, man included. Accusations of man-eating, however, can only be levied against the individual and not against the species as a whole. Man-eaters represent but a small percentage of the lion population. Most lions will run at the sight of man. Lions undoubtedly have a great respect for man, and near human settlements they know full well that human flesh is taboo. Despite the fact that man is the easiest prey of all and can put up little resistance, lions never initiate the attack except under cover of darkness—the darker the night the greater the danger. In daylight there is practically no danger. The first offense is usually attributed to some unusual circumstance, but once having killed and having acquired the taste for human flesh, a lion will become a habitual man-eater. The reaction of the lion is parallel to that of the gambler who wins the first time and figures he has found a way to pick up easy money. A man-eater never devours its prey on the spot as it does other game but drags the victim away to the seclusion of the bush, as though aware that carelessness will defeat him in the end. The most notable man-eating lions were the two that actually held up the construction of the Uganda Railway in East Africa by repeatedly carrying off and devouring workmen. Eventually the engineer in charge, Mr. Patterson, killed the two culprits, and the work was resumed. These famous man-eating lions of Tsava are now mounted on exhibition at the Chicago Natural History Museum.

In southern Asia, tigers take a greater toll of human life than the lions in Africa, which is understandable since conditions are more favorable for them. In Asia, the native population is far denser than in Africa, and the jungles and tall grass close to the native villages provide cover for the tigers in their approach and retreat. As with the man-eating lions, it is only the occasional tiger that habitually preys on human beings. Reports of man-eating leopards are few and unsubstantiated, but a wounded leopard is an exceedingly dangerous animal.

Probably one of the best examples of what happens when uncontrolled animals have lost their respect for man is the wild dogs of the Ramapo Mountains, New Jersey. These dogs were descendants of domestic animals that had been left to forage for themselves. While they had sense enough to avoid closely populated communities and parties out to hunt them down, they would murderously attack an unarmed individual and sometimes treed a man for several days.

Then there are instances where visitors to zoological parks have disregarded signs and paid for their folly by the loss of an arm. The actions of caged animals are unpredictable, and anything thrust between the bars is acceptable as an offering of food.

For a while the bears in our national parks were encouraged to feed at hotel garbage dumps. This proved an interesting attraction for the tourists, but it was not long before the bears became uncontrollable. They ripped cars open in search of food and approached individual tourists to confiscate their lunch and candy. Fortunately, the park commissioners realized the potential danger and put a stop to unauthorized feeding of the animals.

It would be easy, of course, to call the malicious attacks of wild beasts on man a mystery of nature, but it is the business of natural scientists to find the immediate cause. In most, if not all, of the cases, the explanation is found in the definition of the word "wild." Wild, in the sense used for wild animals, means living in a state of nature unaided and without care of man. When animals are fed and cared for by man, they can no longer be classed as wild.

It is not always the inexperienced citizen that gets hurt by savage beasts. Experienced animal trainers and zoological park attendants are often badly mauled and occasionally killed by the animals in their care. The animal trainer who enters a cage of lions, tigers, or bears and makes them perform must be endowed with unfaltering determination and courage. He must not only keep his will dominant but must be able to predetermine the action of each animal. An indication of hesitation or fear would be fatal to the trainer. Only recently in California Miss Grace O. Wiley, an expert in handling venomous snakes, paid with her life for miscalculating the actions of a captive Sumatra cobra. Some unforeseen circumstance caused the snake to strike and sink its fangs into Miss Wiley's finger. She died 90 minutes later.

Poisonous snakes take a large toll of life in warm and tropical countries, but only a large python or boa constrictor would kill a man for food. Alligators and crocodiles are responsible for a few human casualties.

There are instances where fish have become habitual killers as a direct result of man's intervention in their scheme of things. In the West Indies, where the refuse from slaughterhouses is dumped into the ocean, barracudas congregate to feed and have acquired a lust for red meat. So ferocious have these creatures become that it is not safe to bathe on any of the neighboring beaches. On more than one occasion, bathers have been viciously attacked by barracudas and literally torn to pieces by their rows of long spiked teeth before rescuers could reach them.

If you put your foot into one of the giant clams found in certain tropical waters, it will snap shut and hold like a vise, and you may be drowned before help arrives. Divers sometimes encounter octopuses, but the big and dangerous ones are usually in deep water.

On the other hand, dolphins apparently have been instrumental in saving the life of drowning persons by edging them onto the beach.

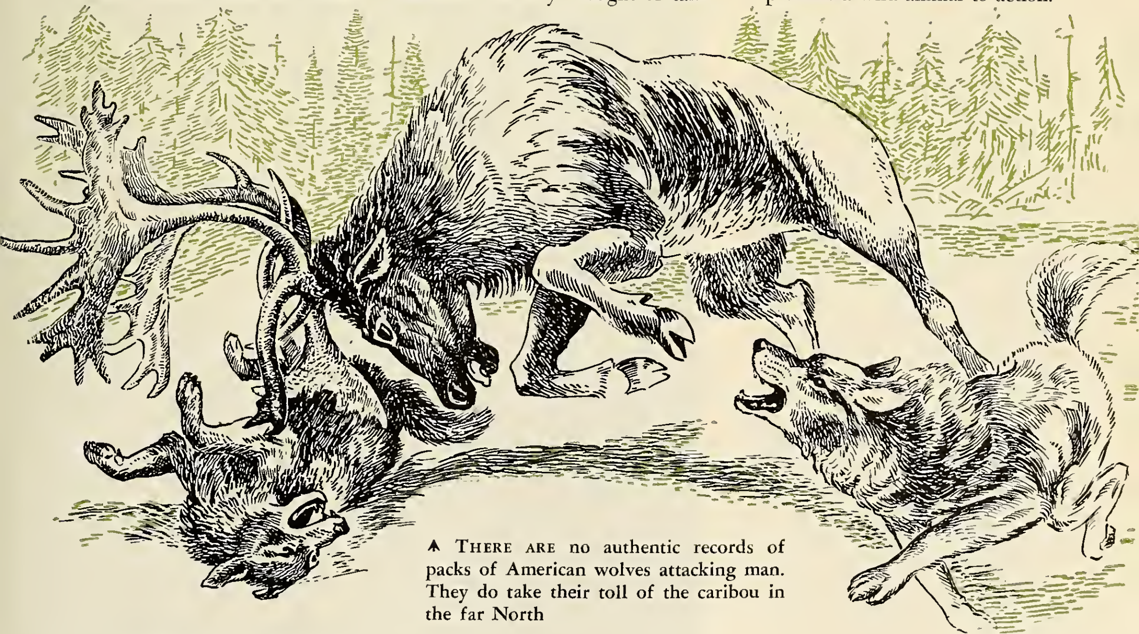
A summary of the principal cases in which so-called wild animals have attacked human beings shows that in most instances the animals have been spoiled by human kindness. Spoiled animals, like spoiled children, will take advantage of liberties extended to them.

Lions and tigers are among the most dangerous animals, and the African buffalo is in some ways even more formidable to hunt. But in answer to the question, "What is the most dangerous animal?" we must look elsewhere. There is a smaller creature that has taken a greater toll of human life than all the other forms of wildlife taken together. It is the rat. Even today, rats exact an enormous tribute each year, and everyone pays dearly for their support. In the war against rats, man has fought a losing battle; the hordes of pestilence carriers are on the increase. In well-governed lands, science has curbed the spread of disease by isolation and innoculation, but once a plague leaks out, the rats are there ready to carry it from city to city and from town to village. Most wild creatures serve some useful purpose, but this can hardly be said of the house rat, unless you argue that overpopulation is a menace to the human race. Unrestricted as an agent for spreading diseases, rats can and have in the past reduced the world's population faster than any other agent, including war. Hitler, with all his machines for destroying life, never approached the awful havoc meted out by rats.

Man is a born hunter, and if he goes looking for them, he will meet the large and dangerous animals. Although hunting is considered a social achievement in some classes, it is one of man's most primitive characteristics. There are those who shrink at the very thought of taking the life of any creature but, cut off from the supply of prepared food, even the timid soul will revert to the primitive instinct and hunt for food.

From the very beginning there has been a struggle between man's kindly nature and his desire to kill. When a child comes in close contact with a potential victim, a kindred feeling for the creature is quickly established, and he will endeavor to protect rather than harm it. Normal children are apt to try to restore life to a victim that they themselves have killed. Given a weapon, be it a stone, stick, or gun, the hunting instinct in a boy quickly dominates his kindly nature, and his sensitive feelings may not be hurt by seeing the victim suffer. With a gun in his hand he has a feeling of power; his ego is bolstered, and he can display his skill.

In developing the ability to reason, man shouldered the responsibility of curtailing suffering. Physical pain is a forerunner of death and is felt by all creatures. It is the first and most vital asset in the preservation of life. When you understand this, you will understand much in the behavior of animals, and you may be less inclined to provoke a wild animal to action.



▲ THERE ARE no authentic records of packs of American wolves attacking man. They do take their toll of the caribou in the far North

This unique photographic telescope is being used in one of the greatest projects in modern astronomy—compilation of the first atlas of the heavens

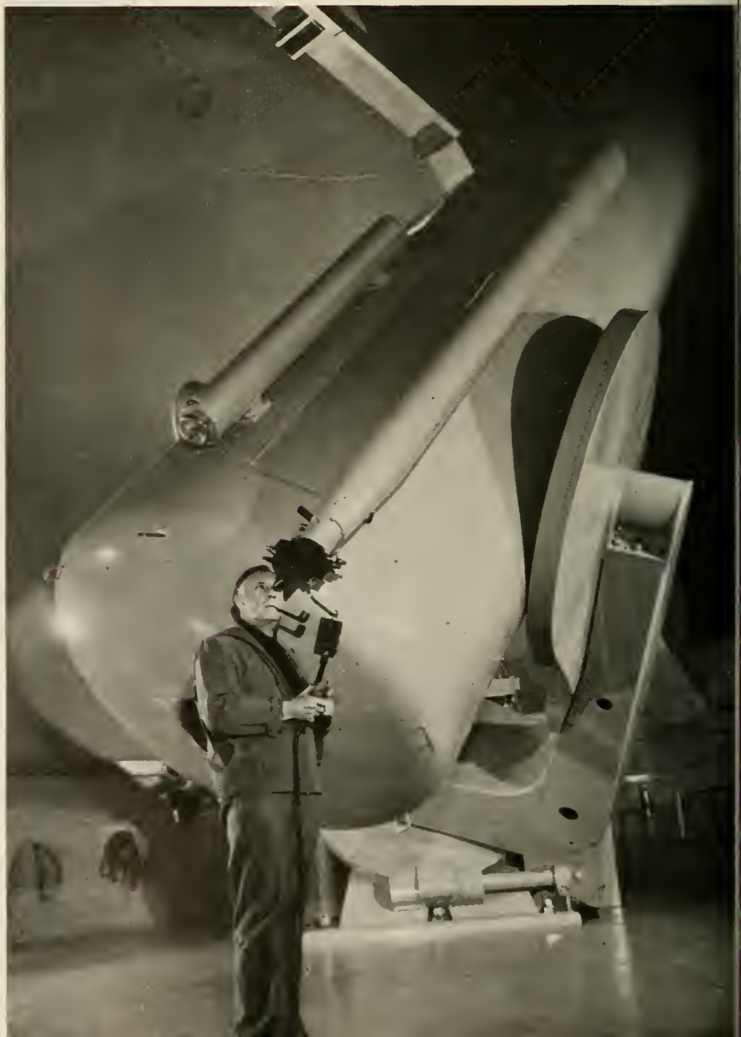
By
Robert R. Coles
Associate Curator, Hayden Planetarium, American Museum of Natural History

"Big Schmidt"

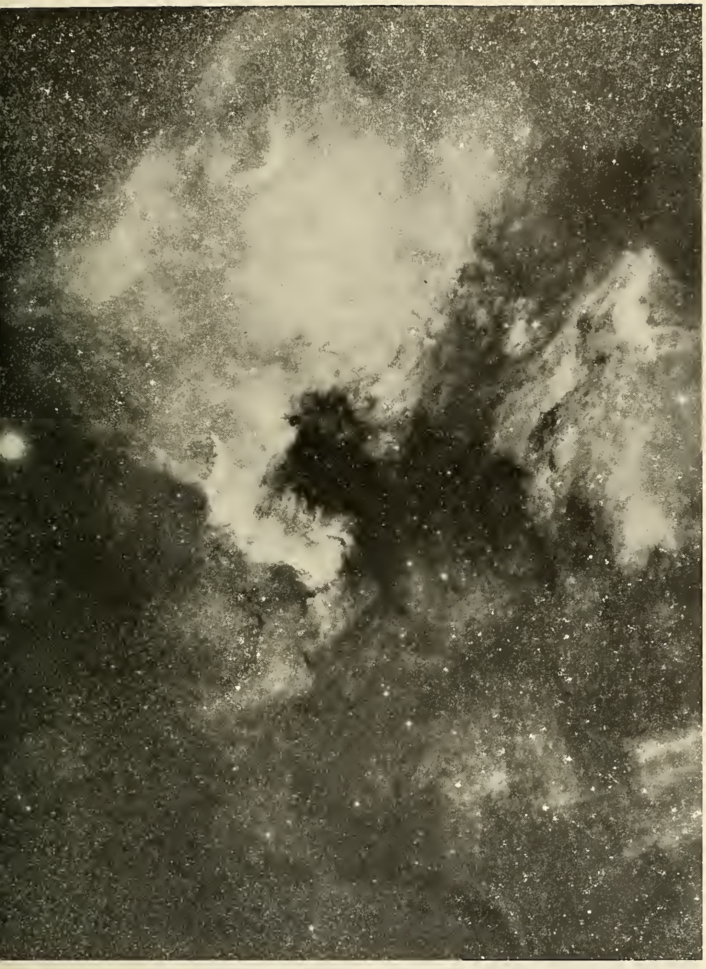
Little Giant of Palomar

All day Tuesday, July 19, 1949, astronomers on Palomar Mountain watched the heavens with more than casual interest. They were hoping for a clear night with good seeing. Fortunately, their hopes were fulfilled. It turned out to be one of those tranquil summer evenings that delight the hearts of the star doctors. The deepening sky became a canopy of velvet in which the brighter stars sparkled like gems. As the final afterglow of twilight faded into the full dark of night, the entire heavens blossomed like a beautiful celestial garden.

It was in this perfect setting that one of the greatest projects in modern astronomy was launched—the National Geographic-Palomar Observatory Sky Survey. The work began with the taking of two photographs of a particularly interesting region of the heavens in the constellation of Cygnus, the Swan. The center of interest in these pictures was the famous North America Nebula, a mass of stars and gaseous interstellar matter that bears a striking resemblance to the continent of North America.



➤ Dr. Edwin P. Hubble, dean of American astronomers, directing the final rehearsal of the 48-inch Schmidt for its exhaustive survey of the sky. Teammate of the 200-inch Hale, this unique telescope has already begun to reveal new and startling facts about our solar system



▲ THE FIRST PHOTOGRAPH taken by the Schmidt of the famous North America Nebula, so-named because it bears a striking resemblance to the continent of North America. The Schmidt phototelescope will in four years complete a survey that would take the 200-inch telescope 5000 years

The object of this program is the compilation of a new star atlas that will include the heavens visible from Palomar Mountain. From that latitude, three-fourths of the heavens surrounding the earth can be photographed with accuracy. About ten per cent more, a so-called "fringe area," can be covered in some degree but not as sharply as the rest. A supplementary survey will be necessary to obtain this fringe area with the desired accuracy, and the remaining fifteen per cent that is out of reach far down in the southern hemisphere. It will involve the making of several thousand photographs on plates measuring 14 by 14 inches, each covering an area of the sky about 7 degrees square. When completed, there will be 20 large volumes, and the atlas will be made available to observatories at cost. It is estimated that the price of each atlas will be about $2,000.

Surprising as it may seem, this work is not being done with the much-heralded 200-inch giant eye of Palomar but with a smaller instrument known as the Schmidt telescope. There are two of these on Palomar Mountain, used in conjunction with the larger reflector. One, called the 18-inch Schmidt, has been in successful operation for several years. Its companion, the 48-inch Schmidt, which was completed last year, is now being employed in the present survey.

To the casual visitor this telescope resembles a huge cannon more than anything else. It looks like something out of an H. G. Wells novel. In reality, it is one of the greatest marvels of modern precision engineering. Its basic design is quite like that of any other reflecting telescope, with a large mirror to capture the light messages from the stars. But there are several small but important differences. These include a different shape for the big mirror—spherical in the Schmidt telescope instead of parabolic. The addition of a specially-designed correcting lens at the center of curvature of the large mirror plus other modifications make it very much better suited for photographic survey work than any other type of telescope, including the 200-inch reflector. The latter, despite its ability to penetrate a billion light-years of space, can photograph only a very limited area without distortion. The Schmidt phototelescope will complete this job in about four years. The "Big Eye" would take 5000 years.

Because of its unique design, the 48-inch Schmidt will photograph a much larger area with almost perfect definition to the edge of the plate. And while the large Schmidt telescope cannot reach as far into space as the 200-inch reflector, it still has a penetrating power of 300 million light-years!

Another surprising fact about the Schmidt instrument is that it cannot be used for direct visual observation. This is because of the way it is built. It is impossible for the observer to get his eye in position to observe the image reflected by the large mirror. In place of the eye, a photographic plate is held in that position to receive and record the image. Being exclusively a photographic device, it is often referred to as the "Schmidt Camera." It is equipped with two 10-inch refracting telescopes for guiding. These are mounted on opposite sides of the barrel so that one is always accessible from the floor, where the astronomer works.

The Schmidt camera was invented about 20 years ago by Bernard Schmidt, an associate at the Hamburg Observatory in Germany. But this unadorned statement ignores the most fascinating part of the story, which focuses on the unique personality of the man whose dreams and endeavors came to fruition with the completion of this remarkable instrument. The story really begins some 70 years ago, with the creation of a lens from the round bottom of a broken bottle by a lad in an Estonian Island village. Young Bernard Schmidt was the eccentric son of a German father and a Swiss mother. Even then, young Bernard was different from other children. Friends and neighbors thought him queer because of his shy manner and the insatiable curiosity that, indeed, on one occasion almost cost him his young life. At ten, Bernard became interested in explosives and one day set out to build a bomb that would produce a tremendous noise. After packing a quantity of powder into an iron pipe, he attached an improvised detonator. Just as his experiment seemed to be progressing successfully, there was a terrible explosion. The bomb went off too soon—and young Bernard lost one of his arms.

Had it not been for this accident, astronomers of today might be without the Schmidt camera, for the budding scientist directed his attention away from explosives and into the less dangerous avenue of optics.

His utter lack of equipment and funds did not deter him in the least. It was only a year or so later that he fashioned the crude lens from the bottle glass by grinding it in a saucer of sand. Later, upon hearing of the new process called photography, he built a simple camera out of an old cigar box and began to experiment with the film then available. In these two projects can be recognized the root of the great instruments that today bear his name.

▲ Enlargement of a small section of a test-run photo made by the "Big Schmidt," showing a portion of the Milky Way in the constellation of Monoceros. This nebula is actually a cloud of dust and gas illuminated by near-by stars

From those early formative years, Schmidt's major interest was optics, and when ready for higher education he sought expert instruction in Sweden and later at a technical school near Jena, the famous optical center in Germany. After that he began experiments on his own and ground his first professional telescope mirrors. It was a hand-to-mouth existence, but he eventually became associated with the Hamburg Observatory. It is reported that he was a most unusual man—an individualist of the first order. Among other eccentricities was his habit of working in a claw-hammer cutaway coat and striped trousers. Little interested in money, he rejected several remunerative positions in favor of work more in line with his special interests. His colleagues recall how they often saw him pacing absentmindedly about the streets of Bergdorf, a suburb of Hamburg, with his hat pulled down and his cigar tilted up so that it seemed his hat brim might be ignited at any moment.

This shy, retiring genius, who coveted independence above all else, was the man to whom the astronomers turned in the 1920's for the solution to one of their most technical and perplexing problems.

At that time it was impossible to take telescopic photographs that were clear and sharp over the entire negative. Several theories for solving this problem were submitted to Schmidt, but none of them seemed to him practical. In 1926, he announced his ideas for a solution, but they were not favorably received. He said no more but refused to be defeated. Three years later he was crossing the Indian Ocean, en route to the Philippines on a German eclipse expedition. With him was Dr. Walter Baade, of the Hamburg Observatory. In the course of a conversation, Schmidt mentioned that he had worked out the solution for the "perfect mirror." He proceeded to explain the principle upon which it should be designed.

Dr. Baade enthusiastically suggested that Schmidt should build one on his return. But it was not until the summer of 1930 that he completed his first test instrument, a 14-inch model. One Sunday afternoon he invited Dr. Baade to witness a demonstration of his revolutionary phototelescope. From an attic window, he trained it on a cemetery some distance away. Dr. Baade peered into the eyepiece.

"Can you read the names on the tombstones?" Schmidt asked.

"Yes," came Baade's elated reply. "But I can really see only one thing —the optics are absolutely marvelous!"

Astronomers were skeptical of the possibilities, however, and real progress was not made until Dr. Baade presented the idea to the astronomers at Mt. Wilson, California, in 1931. Bernard Schmidt died in 1935 without knowing whether his dream would ever be translated from blueprints to reality.

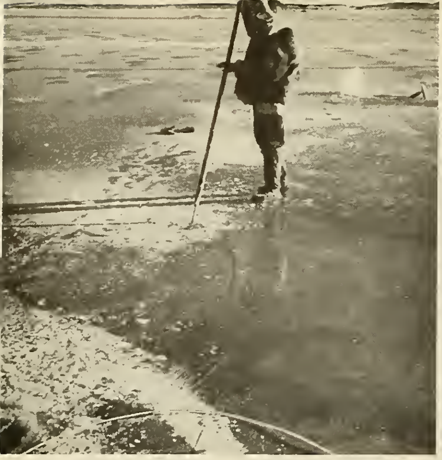
Already the 48-inch Schmidt has proved it superiority in the field of survey work. It made astronomical history last summer when it captured the image of a previously unknown asteroid, or minor planet, which moves nearer the sun than any other known body except a comet. At times this object, which is probably less than a mile in diameter, approaches to within 22 million miles of the sun. Further study of its behavior may shed light on the evolution of the solar system and will perhaps aid astronomers in more accurately determining the mass of Mercury.

In this survey two exposures are being made in every region of the sky covered. One of these is on film sensitive to red light, the other on film sensitive to blue. In many instances the two exposures reveal very different pictures. This is because some stars radiate a predominance of red light while others show more of the blue. Another advantage of the red-sensitive film is that it is more efficient than the blue in penetrating the haze that is so pronounced in some regions of interstellar space. This is particularly dense in the region of the Milky Way.

▲ Sky survey experts: Dr. Albert G. Wilson (*left*), key astronomer in the project, checks over some test negatives, while Dr. Walter Baade, close associate of the inventor of the "Big Schmidt," looks on

While it is impossible to list all of the benefits of such a survey at the present time, a number of them are quite obvious. Estimates indicate that the survey will record a total of some 5000 million stars and perhaps 10 million stellar systems beyond our galaxy. It will serve primarily as a patrol camera for the larger 200-inch telescope. In addition, the atlas will be a useful research guide for many other observatories in the United States and abroad. It will undoubtedly add to our knowledge of the architecture and dimensions of our own galaxy and provide a more complete census of the various types of objects it contains. It should also yield valuable information on the distribution and density of matter in interstellar space and perhaps offer a clue to the origin of the stars. In the past, these nebulous clouds have proved very annoying to the astronomer by hiding much of the cosmos. The use of red-sensitive film will carry our sight farther into these mysterious depths of space. At the same time, the survey will reveal important facts about the distribution of thousands of galaxies of stars (the so-called island universes) beyond the outposts of our own stellar system. Thus it should provide a better understanding of the over-all structure of the cosmos. Last summer's discovery of the new asteroid shows that the camera is already on its way to revealing new and startling facts about our own "little" corner of space—the solar system.

The possibilities that lie ahead in this great undertaking are truly startling. It will certainly reveal scores of celestial marvels as yet unknown to the most learned astronomers. Quite possibly the discoveries of the 48-inch Schmidt during the next four years will overshadow anything that may come from the more publicized 200-inch Hale reflector. Certainly it will more than justify its name — the Little Giant of Palomar.



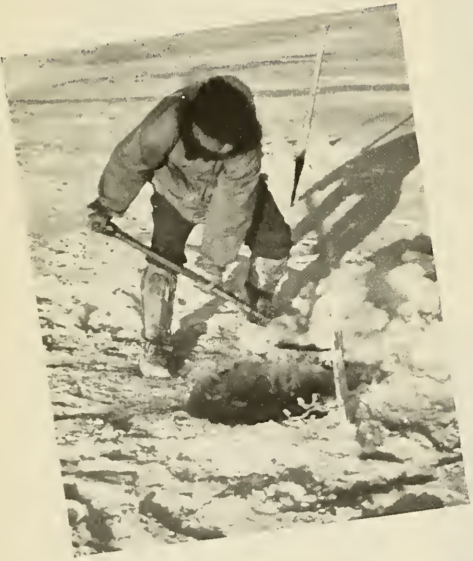
▲ SEVERAL HOLES about fifteen feet apart are chopped in the ice. Then a line is threaded beneath the ice by means of a long pole, and a net is drawn through and fastened at the two end holes

Fishing under the ice

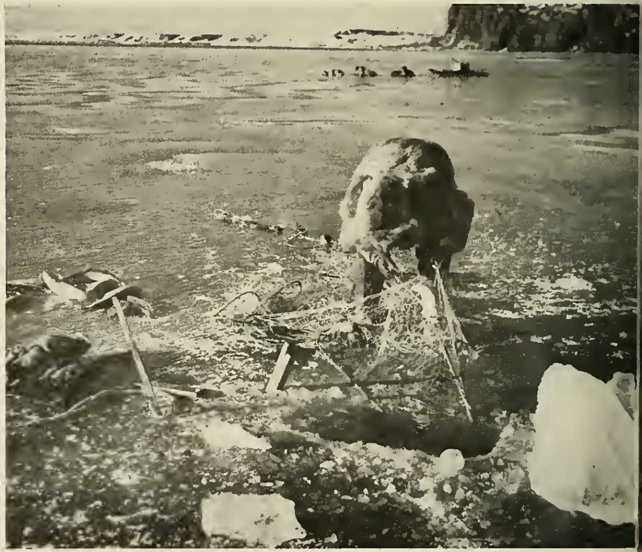
An unbroken expanse of ice does not prevent the wily Eskimo from harvesting the bounty of the sea

By THE REV. CANON J. H. WEBSTER
St. Andrew's Mission, Coppermine, N. W. T.

Photographs by the author



▲ AFTER the net is set, only the two end holes are kept open. The others are allowed to freeze over. This boy is removing ice that has been broken by the long-handled chisel in the background



▲ TO REMOVE the fish, the net is loosened at one end and pulled out through the other hole, with the line still attached for rethreading. Note the dogs waiting in the background

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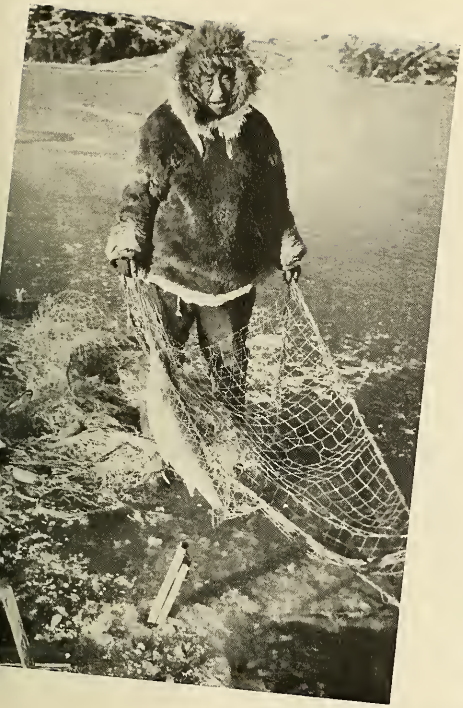
MISSION: MALARIA

Continued from page 111

the same cage with a different partner, it showed little concern. However, if we put one in a different cage, either with the same or with a new mate, it dashed about wildly before settling down. Apparently remaining in the same cage was of more importance to the animals than remaining with same partner.

Naturally we had hoped that our caged pairs would eventually present us with elephant shrewlets, but we hoped in vain and saw no signs of mating. Later we learned that a South African embryologist had been attempting to raise these animals in captivity for 20 years without success. Babies born shortly after capture were destroyed by their mothers, but some brought in along with the females were nursed and carefully attended. One or two young are born at a time. They are quite like the adults except for scattered long black hairs in the coat.



◄ CHILLY WORK with bare hands, but well worth it. In some parts of the Arctic, seals are caught similarly in nets set around the breathing hole to which the seal must come periodically for air

▼ ICEBOX: a storage bin made of slabs of ice sealed together with slushy snow, which will keep the fish safe from prowling animals

Fear among elephant shrews is expressed by low screams, excitement and warning by a rapid and surprisingly loud rapping with one hind foot. Four shrews, two males and two females, bit us consistently when we handled them, but none of the other hundred did.

We found no fleas or lice in their fur but many small ticks. Tapeworms and nematodes were common in their digestive tracts.

At the same time that we were domesticating our animals we were studying hundreds of samples of their blood. The malaria looked surprisingly like human malaria but lacked those important asexual stages that keep the infection alive in the blood without further innoculation by the insect. Periodic examination of the blood, often at six-hour intervals day and night, failed to disclose these stages.

We were still perplexed over this strange phenomenon when the time came to fly the animals back to Dr. Huff at the Naval Medical Research Institute. Another worrisome time came then, for I was sent to Nairobi for an operation, and Chief Lawless was left alone with our "patients." The next day the rest of the naval party returned to Juba and helped Lawless prepare the elephant shrews for shipment in light metal cages that we had ordered from Nairobi. Commander Ruebush was assigned to head the party back, and he and Lawless recaged the first lot of elephant shrews ever to be sent to the United States. A few days later, when the big Navy plane had taken them across the Atlantic and settled down at the Washington National Airport, the animals were, I am told, more fit than their keepers. All of the 104 elephant shrews that we had started taming a month earlier arrived safely.

Even after extensive work on the parasite of the elephant shrew, Dr. Huff now finds some of the main problems unsolved. His original demand for a laboratory mammal with a type of malaria similar to man's has not been satisfied by the elephant shrew. Aside from the difficulties of keeping the animal alive and the apparent impossibility of raising a colony in the laboratory, no way is as yet known for transferring the infection experimentally from shrew to shrew.

But the disease does suggest a host of problems that it is important to solve at this stage of malaria research. We made another short trip to the southern Sudan during 1948 to investigate further elephant shrew malaria and other blood diseases of the wild animals there; but that is an unfinished story. As this is published, we are in the midst of a three-year tour of African duty for the Navy, and our first assignment is to try to fill in the many gaps in our knowledge of elephant shrew malaria.

BOOKS

Continued from page 103

inherent in such power, partly, he suggests, because civilization as a whole was still firmly rooted in a Christian ethic that could govern the use to which it might be put. But also, it seems, because the potential then available was still far from carrying the destructive force which modern science can place in ruthless hands. When one of the great physicists declares that no knowledge is better than modern science in the service of the irresponsible, we have reached a stage that is nothing less than critical.

Dr. von Weizsäcker in his *The History of Nature* has faced this transcendent problem of our time by writing a book on the essence of nature including man. He bridges the gaps created by our extreme specialization and lays before the reader a masterly summation of the historic course of nature, spanning the origin and structure of the universe on the one hand and the nature of man and his soul on the other.

The emergence of human consciousness and of a soul become in Dr. von Weizsäcker's history the culmination of a long series of events which alone can make their uniqueness understandable. It is only in the soul that hope for the future can be found. Knowledge with love is mankind's salvation.

This is a deeply moving book based on a broad erudition, simple in outline, profound in its insights.

Harry L. Shapiro

AMERICAN HEARTWOOD

---- By Donald Culross Peattie

Houghton Mifflin, $3.50
307 pp., 19 woodcuts

A NEW book by Donald Culross Peattie will be hailed by all American naturalists. The present volume, however, is a series of 19 episodes from the "heart" of American history, written against the background of its exploited woods. The 19 chapters (whose subjects are well veiled in their literary titles) take one from Erik the Red through the boom and bust of the Comstock Lode. Each isolated narrative is told with authoritative detail, with the color and atmosphere of its times, in a style that is as graceful as it is fluent and with an imagination that adds immeasurably to its vividness. It is Peattie the historian who speaks more than Peattie the naturalist. Although many tales start and end at his California garden home with reflections worthy of John Burroughs, in others the naturalist may be obscured.

Peattie the historian—or perhaps, the patriot—assumes a new stature in this volume. He believes firmly, devoutly, almost simply, in the inherent greatness and goodness of America. Superlatives abound, directed always toward our democracy, our freedom, our abundance, our way of life. Of the rest of the world, he says little or nothing. If he must mention a few stains in our history, it is only to glorify our deeds of erasing them. As an historian, he looks backward, not at the present or forward. The problems of our economists today and the deep concerns of such conservationists as Osborn and Vogt are incompatible with his sense of American perfection. Nor is he a lover of the primitive wilderness, either for sentiment or for science. The disappearance of the passenger pigeon and the bison go not only unlamented but even as praiseworthy because way is made for farms and fences, wheat and clover, of his greater America.

Frank E. Egler

LETTERS

Continued from page 98

ground was literally covered with tiny baby frogs. He dismounted and, upon examination, found them very active, uniform, and about the size of a large horsefly. The wagon ruts in the old logging road he was traveling were filled with them. It was really impossible to avoid tramping on them.

Where could these frogs have come from? Buzzle and Trowl creeks were fed by the winter's snow and by springs and therefore went dry in the summer. Marble Creek was over the rise of the hills and mountains. The St. Joe River was at least sixteen miles away.

The baby frogs came with the rain, but from where? Is there some simple explanation for this apparently baffling occurrence?

Mrs. Rena Collins Fairfield
Spokane, Wash.

The following comments are offered by Mr. C. M. Bogert of the American Museum's Department of Amphibians and Reptiles:

In referring to "frogs," Mrs. Fairfield is using the correct name for all tailless amphibians, but the creatures her husband saw were undoubtedly toads in the popular sense of the word. Few frogs wander far from water, whereas the toads, once they have graduated from the tadpole stage, are principally land dwellers.

The appearance of hordes of small toads following a rain is not uncommon in arid portions of the United States. In Idaho those seen may have been either the Rocky Mountain Toad (*Bufo w. woodhousii*) or the Northwestern Toad (*B. b. boreas*). Farther south in the deserts one occasionally sees similar swarms of the Colorado River Toad (*B. alvarius*) or the Desert Toad (*B. punctatus*).

The explanation is relatively simple. Toads deposit their eggs in pools, usually in the spring, but in arid regions deposition must await the rainy season as well as suitably high temperatures. Seepages or springs, some of them temporary, provide sufficient water to permit toads to carry out their breeding activities. Pools in almost any situation are utilized. Even relatively tiny pockets along rocky cliffs often contain the characteristically black tadpoles, which emerge from the egg within two or three days after deposition.

The tadpoles are dependent upon plants such as the green algae or "pond scum" as well as upon small animals that appear in the pools soon after they are formed. The tadpoles of some toads are able to dispense with their gills within a month and a half, meanwhile having acquired legs as well as lungs that leave them free to emerge and hop about on the land. They are ordinarily most active at night, and the young may spread out in all directions from the isolated breeding points. To avoid the dry surface, they first seek shelter near the natal pool in rodent burrows, under rocks, or in any sort of crevice where some moisture is retained. Migration from the breeding site, where the available insect food of the transformed young can scarcely support many toads, is restricted until the advent of additional rain. Thereupon, the young toads come out from their moist places of concealment and continue their journeys, sometimes all of them in one area heading in the same direction. In most instances we can do little more than guess concerning the stimulus that directs the migration, however.

Doubtless many young toads are killed before the rain subsides and once more forces them to locate suitable shelter. A more or less permanent abode is finally established from which the toad emerges to feed whenever there is sufficient humidity in the air at ground level. No actual pool is necessary because the toad is able to absorb water from the moist earth that surrounds it in its chosen sanctum. The desert toad, an inhabitant of dry canyons, possesses a flattened body that presumably enables it to find suitable crevices with greater ease. In the Grand Canyon, for example, rains bring it forth in great numbers. Otherwise it is rarely encountered, although I once looked beneath an oak keg placed under a trickle from the rocks in Bright Angel Creek and found over two dozen toads solidly packed beneath the moist wooden bottom.

Dubious as it seems from superficial appearances, moisture is present not far below the surface in many desert regions. Ordinarily, to be sure, there is not enough

Photo by Gladys Diesing

▲ Cypress and the sea. **Flattened and twisted by the continual buffeting of the wind from the sea, the Monterey Cypress (*Cupressus macrocarpa*) grows in its natural state only in a limited area a few hundred feet from the ocean. This picture was taken on the Seventeen-Mile Drive which makes a circle of the Monterey Peninsula from Monterey to Carmel, California**

to flow into an excavation. Nonetheless, in the large dunes not far south of El Paso in Chihuahua, I once followed the example of the local coyotes, whose excavations I could see, and found that murky but quite palatable water was available scarcely more than a foot below the surface. Sufficient moisture was present on the surface in the depressions between the dunes to satisfy the needs of a toad, with its absorbent skin.

Thus toads manage to survive in portions of the desert where the mean annual rainfall is no more than three inches. Indeed, on the only occasion when I crossed the extremely arid section between Gila Bend and the Colorado River during a night rain, several toads were seen along the highway. Where they had found enough water to breed I could only guess, but it was a fair assumption that if I had searched the region at the right time, I might well have found the young migrating from one of the few breeding sites that must exist in the region. How far they travel no one knows, but at times it must be a matter of miles.

The sudden appearance of swarms of toads following thundershowers has given rise to the myth, widely believed in many parts of the world, that it "rains toads." Indeed, a violent updraft accompanying a thunderstorm might occasionally carry a few small toads upward and drop them at a distance. So the myth may have this much foundation to strengthen it, but ordinarily the great numbers of toads that appear after rainfall in arid regions have come from their places of seclusion in the ground—not from the sky!

Kiwis from Way Back

Sirs:

I was very much interested in reading in the February issue of Natural History the article concerning the Kiwi. It might interest you to know that this name was used for the ground forces in the U. S. Army Flying Service during the First World War. My brother was in Army Aviation some time in 1917 until the middle of 1919. During his period of service, I heard him use this phrase to designate aviation ground troops on more than one occasion. He said that this was quite common in the service, although the soldiers did not seem to know whether the bird was from Australia or New Zealand. They knew very little about it, except that it could not fly.

Alfred W. Gale

Troy, N. Y.

▲ An "usher" at the opening of spring: the wood frog (*Rana sylvatica sylvatica*) wears a distinguishing black mask about the eye

Belted Kingfisher

Sirs:

At your convenience, I would appreciate your comments on the following:

On Dec. 12, 1949, I saw a Belted Kingfisher feeding while on wing from the water in a creek near my home. There was broken ice in the water, as the temperature had reached three degrees above zero two days previous.

Reference books I've checked say this species winters in southern United States. Inasmuch as I've never heard of these birds being seen hereabout at this season of the year, I'm curious to know if this is an unusual occurrence.

William A. Breen

Troy, N. Y.

The following comments are offered by Mr. C. K. Nichols of the American Museum's Bird Department:

Although the Belted Kingfisher is recognized as a migrant bird in the northeastern part of the United States, it is true that some individuals will remain throughout the winter if there is open water with food in the vicinity.

In southern New York and in northern New Jersey, a few may be found every winter unless the weather has been very severe and the streams completely icebound. It must be a rare occurrence for a kingfisher to winter in the vicinity of Troy, for it is probable that its opportunity to find food in that latitude is rather slight. But this has been an unusually mild winter, and the feeding conditions in your vicinity have not been too difficult.

Do Crickets Damage Clothes?

Sirs:

Your article on the clothes moth was most valuable and has saved much time and energy. . . . I would now like to ask whether there is anything in a belief here in the Rio Grande Valley that our crickets eat wool. People chastise me for allowing them to remain in my house.

Gladys H. Osborne, M.D.

Harlingen, Tex.

The following answer to this question is offered by Dr. C. H. Curran of the American Museum's Department of Insects and Spiders:

In normal outdoor conditions, crickets are vegetarians, but when they enter warm buildings, they are liable to change their habits, and they may then damage woolens, cottons, and silks. The damage usually results from the presence of foreign substances on these materials. Grease spots or stains will attract them. Clothes subject to perspiration and put away without cleaning attract them because of the salt present. The starch in clothing, both old and new, furnishes food. It is while eating these added substances that cloth is damaged.

Many people consider the presence of crickets in the house a good omen. A singing cricket is supposed to bring good luck to the household. Others believe that the singing of crickets in the house portends the early approach of winter, a natural assumption where American crickets are concerned, because they enter buildings to escape the cold. The house cricket, a native of Europe but now occurring in parts of the United States, is the creature made famous by Dickens's *The Cricket on the Hearth.* In this country the late Frank E. Lutz studied the sound-making apparatus and recorded the sounds of this cricket (see Natural History, December, 1938), and the cheerful chirps of these creatures could usually be heard in his home.

The Chinese and Japanese highly prize the "songs" of their native crickets, and keep the insects in cages, some of them quite expensive, in the same way that we keep prized canaries. Male crickets are naturally pugnacious, and the Chinese have also developed a fighting race. From $50.00 to $100.00 (old currency) was about the average price paid for a good fighter. Fights between good fighters would attract thousands of dollars in bets. A cricket of Canton, known as "Ghengis Khan," is said to have won fights with as much as $90,000 (U. S.) at stake. When kept as pets, crickets will eat a variety of leafy vegetables. Lettuce is a favorite food.

Epic to be Proud of

Sirs:

Let me express appreciation of Louis R. Huber's splendid tribute to certain of our fellow Alaskans in his article, "The Incredible Conquest of Mt. McKinley." From its all-inclusive title to its final Anglo-Saxon "grit," no more words are needed. The excellent reproductions of Mr. Washburn's well-chosen photographs round out the story of an epic of which we of the North can well be proud.

Frank H. Waskey

Fortuna Ledge, Alaska

Sirs:

May I just take a moment to compliment you on the recent issues of Natural History Magazine. I notice my children seem far more interested in it than they have been in the past few years, and I know that I am finding a tremendous amount of enjoyment in simply looking through it. I also find that I sit down to read an article through rather than just to thumb through the pages as I used to do.

You certainly are doing an excellent job. Congratulations!

Irvine H. Millgate,
Director of Visual Education

Boy Scouts of America
New York, N. Y.

April

NATURAL HISTORY

1950

Golden Anniversary 1900-1950

Fifty Years o

By F. Trubee Davison

President, American Museum of Natural History

The American Museum Journal
April, 1900
The American Museum Journal
NATURAL EVOLUTION CONSERVATION
NATURAL HISTORY
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JULY AUGUST, 1925
No. 4
NATURAL HISTORY
NATURAL HISTORY
NATURAL HISTORY
HISTORY April 1937
October NATURAL HISTO
Roy Chapman Andrews · Jade Art · Your Ow
Flight Into New Guinea · Shell Fashions · The
April NATURAL HISTOR
Lost Worlds Reborn · Fishing Bats
Fur Seals · Fiji · Pottery-making
April NATURAL HISTORY 1950
Golden Anniversary 1900-1950
FIFTY CENTS

Natural History Magazine had its origin in April of 1900 with the publication of a small, 16-page leaflet, *The American Museum Journal*.

In those early days, with something less than 1000 members on its rolls, the Museum felt the need for a periodical that would provide information on Museum activities and exhibits to scientists and members.

What is known throughout the

Progress

world today as Natural History Magazine was at that time envisioned as an aid to a small group of scientists and laymen. The initial publication, under the careful editorship of Dr. William K. Gregory, who is now known internationally as one of the world's foremost authorities on comparative anatomy, was successful in acquainting this audience with the activities of a relatively young institution.

The first half of our twentieth century might well be termed the era of scientific awakening. Probably no other period in history has been marked by such outstanding scientific achievements. The very term "science" has only come into broad usage during this half century when a bewildered public sought to keep pace with the almost unbelievable accomplishments of the scientists.

Hundreds of magazines have come into being during this time, each competing for the public eye. Honest reporting has had to compete with propaganda journalism. The survival of serious, informative, and truly inspiring periodicals has been threatened by sensational ones. The progress we have enjoyed has been made possible by the encouragement and support of those who believe in these objectives.

Publishing activity has been by no means less feverish in the scientific field than in any other. Amid the spectacular interest that is daily captured by the technological sciences, progress with a magazine devoted to the enduring truths of nature has not been easy. There is a far greater volume of material published each month on the physical and mechanical sciences, but we are gratified to learn that few magazines are saved from the wastebasket and cherished so long by their subscribers as Natural History.

The story of Natural History is, I believe, unique in publishing annals. The problems confronting every commercial publication have sometimes seemed minor when compared with those Natural History has endured for half a century. In commercial publishing, every resource at the command of the publisher is directed toward the magazine, its production, its editorial make-up, and its promotion and circulation. Natural History is not published by a commercial concern. It is published by a great American scientific and educational institution as but one phase of an extensive and world-wide program which exerts a tremendous educational influence on millions of people every year.

In view of the scope of the Museum's activities, plus the limitations of staff and budget expenditures in all departments, it can readily be appreciated that the Museum has been unable to give Natural History Magazine the financial support it certainly deserves. The severe limitations under which Natural History has had to work for the past 50 years would have long since relegated to oblivion most commercial publications. Indeed, many periodicals favored with abundant operating capital have gone under during this period.

During the early years of its existence, the editorial content of Natural History was directed solely to those of a scholarly, scientific mind. A circulation saturation point was soon reached in this limited audience. Consequently, Natural History broadened its coverage so that its editorial content would be found understandable, entertaining, and educational to a much larger group. An almost insurmountable problem, however, was to make the American public aware that such a magazine was available. This was a job of promotion and selling.

As every person engaged in business knows, to promote and sell a commodity successfully entails considerable financial expenditure, and this the Museum was unable to underwrite. Those in charge undertook to accomplish a job that was readily labeled "impossible" by professional circulation experts. Since we could not raise ourselves in any other way, we had to do it by our own bootstraps.

The circulation growth of Natural History has not been meteoric, but its success does astound the commercial world when it is understood how little was spent to achieve our present circulation of more than 40,000 paid readers. It is significant too that the Magazine has not resorted to exotic interpretation of the natural sciences in order to garner widespread attention. The editorial advisers have felt that anything verging on the overdramatic would render Natural History ineffective in the dissemination of facts in the natural sciences.

During its existence, Natural History has published more than 15,000,000 words and over 27,000 illustrations. It has given its readers the personal accounts of the most celebrated explorers of our time, and it has set no limits on its geographical or historical range. It has stirred many an American home both with the wonders of far-flung places and with the sometimes more startling mysteries and marvels of nature close to home. All this has been accomplished through the unflagging industry of a small editorial force and of an office of circulation and promotion that has been seriously handicapped by shortage in personnel and facilities.

The officers of the Magazine feel that there are hundreds of thousands of people in this country and abroad who would welcome learning about Natural History and who would be willing to subscribe to it. Here is a family magazine that inspires wholesome thinking and embodies a philosophy of simple, intelligent living. We enter our second half-century with gratitude for the encouragement and support that all our readers have given us and with fervent hope for the future of a periodical that exemplifies and moves forward in a sphere of human thought and experience that is constantly increasing in importance.

Keystone

Gendreau

The Gifts of Nature

By Herbert Hoover

I was a boy in the days before our civilization became so perfectly covered with cement and bricks. As a boy in the villages of Iowa and Oregon, aside from chores, it was my business to discover the world all over again. There were the wonders of the woods and the streams with their animals, their birds, and their fishes. There was the miracle of the growing crops, the excitement of the harvest and of the homemade Christmas. There was the comfort of the family fireside in a civilization where every season produced the bread, the meat, the vegetables, and the fruit which gave social security over the winter.

Afterward my engineering profession took me to many foreign lands, where I dealt with the people of many nations and nationalities. My boyhood interest in the birds and the beasts and the fishes continued.

And it has been my privilege to work with great spiritual leaders and great statesmen. I have worked in governments of free men and in governments without freedom. I have seen happiness; I have witnessed destruction, great troubles, and sadness: the battlefields of two frightful wars, the suffering of famine and pestilence. I have seen people devoted to their governments, and I have seen people rebel against their tyrannies. I have seen them cling to recreation at the woods, the streams, and the sea as an escape.

Those countries where the people were devoted to their government were those in which the individual was free to choose for himself and to develop his own talents and enterprises. But the opportunity to develop was limited by the natural resources, and these came from Nature itself—not from governments. This development of nature's offerings was not alone their bounty but was the product of freedom and the ingenuity of races. We descendants of Western Europe are mechanically-minded and take to making and running machines, while the peoples of Asia and Africa, with different backgrounds, imitate and fumble with them.

But amid all these machines, bricks, and cement, there is the primeval joy of all races of getting back to nature—for recreation and to wash one's soul of the complexities of our modern life.

One of the products of the mechanical age is to give us more spare time. What we do with this leisure has to do with the spiritual life of both the individual and the nation. As a nation, Americans have done much to bring recreation nearer to nature itself. Between 1928 and 1932, our National Parks and Monuments increased 40 per cent—and we have improved the hunting and fishing. Hunters and fishermen are not those who fill our jails.

Many of these opportunities of the out-of-doors were destroyed by the march of cultivation of the land and the use of our resources for personal comforts. But we still have great opportunities, for no one can destroy the magnificent monuments of nature. And these bountiful gifts with which our land is endowed are part of our sacred national trust.

From them, the contemplation of the flow of the stream, the cathedrals of the redwoods, the majesty of the mountains—all remind us of our humble role in the order of things. Many of us have to work at the bench and in the shop. We cannot go to these refreshments of the mind as much as we would like. But such institutions as the American Museum of Natural History make available to all of us and our children the wonders of nature—and remind us of the Gifts of Nature from which we derive so much of our strength.

NATURAL HISTORY

The Magazine of the American Museum of Natural History

F. Trubee Davison, President — Wayne M. Faunce, Vice-Director In charge of Publications — Albert E. Parr, Director

VOLUME LIX—No. 4 — **APRIL, 1950**

Mitten Butte ....Cover Design
From a Kodachrome by Josef Muench

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THE COVER THIS MONTH

Mitten Butte is a familiar landmark to many travelers who have chosen to put the well-traveled routes behind them and struck north from Kayenta, Arizona, into Monument Valley. Throughout our Southwest and even the world, the spires and mesas of Monument Valley stand as a classic example of the startling topography that can be carved by natural forces in an arid or semiarid climate. Warm hues of brown and yellow tint the buttes and shafts of rock that dot this elevated landscape and impart an unearthly beauty. Most visitors, however, particularly if they visit the region in a hot, dry spell, do not think of this portion of our land as being a riot of floral coloring. The cliff rose, technically known as *Cowania stansburiana* whose golden blossoms enliven the foreground of this photograph, is a leafy evergreen shrub that grows frequently on cliffs and belongs to the rose family. It grows to a height of from three to twelve feet and occasionally twice as much. It is often called quinine bush because its twigs and leaves are quite bitter, but this does not prevent cattle, deer, and sheep from feeding upon it. The Hopis prepare from the plant an emetic and a wash for wounds. —Ed.

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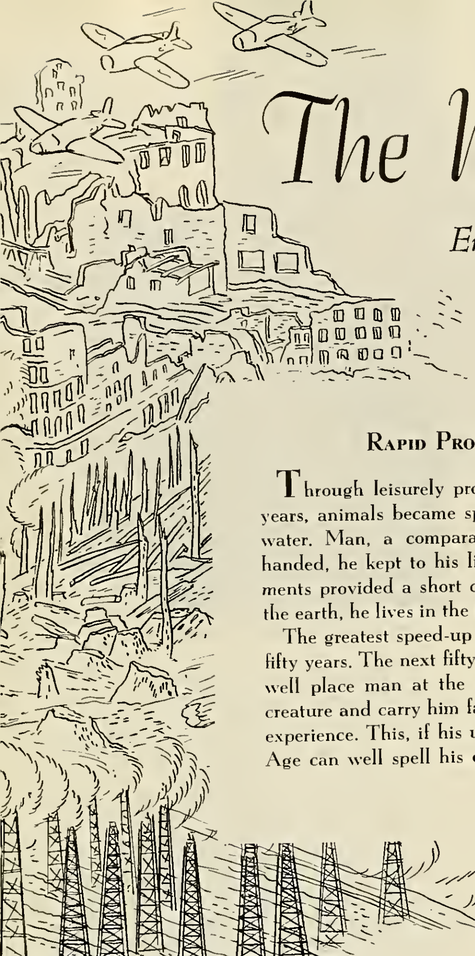


The Next Half Centur

Eight scientists at the American Museum give a qui

Rapid Progress or Rapid Defeat

Through leisurely processes requiring millions and millions of years, animals became specialized for life on earth, in air, and in water. Man, a comparative newcomer, was earth-bound. Barehanded, he kept to his limited habitat until technical accomplishments provided a short cut across the eons. Today he has overrun the earth, he lives in the air, and only the ocean depths oppose him.

The greatest speed-up in this human expansion came in the past fifty years. The next fifty, with the Atomic Age luring him on, may well place man at the utmost capacity for life achieved by any creature and carry him far beyond anything common to our present experience. This, if his use of the shining tool is wise; the Atomic Age can well spell his doom.

Harold E. Anthony
Chairman, Department of Mammals

New Comprehension, Power, Guidance

Constructive study of evolution will oppose the powers of physical destruction and spiritual bondage. The synthesis of evolutionary science will increasingly involve all life sciences and extend farther into the psychological and social sciences. The goal is increased comprehension, power, and guidance: *comprehension* of how life has arisen and developed, of our place in the living world and the universe; *power*, through knowledge of the principles of organic change, to influence desirable development of man and other organisms; *guidance*, derived from true understanding of life, toward the achievement of sound ethical and social values as the basis for peaceful brotherhood of mankind.

G. G. Simpson
Chairman, Department of Geology and Paleontology

n Science

pse of tomorrow

FEWER ATOMIC WORRIES—GRAVER POPULATION PROBLEMS

This is not a prophecy. It is an article of faith combined with a piece of guesswork. First, I believe, in common with many others, that mankind has a future, because man can and will rise to the moral demands implicit in the possession of the self-destructive powers he now has learned to manipulate.

Admitting this probability, I judge from existing population dynamics and from advances in technology that the world's population will increase by at least fifty per cent in the next fifty years. The task we face is the tremendous one of understanding the economic, social, and political stresses that will result and of discovering a method of dealing with them.

HARRY L. SHAPIRO
Chairman, Department of Anthropology

EMPTY MINES—HEAVY STATUTE BOOKS

The increasing drain on our mineral resources makes it certain that the accessible deposits will be depleted by the end of the century. Two developments are to be expected: a vigorous investigation of more remote sources, and expensive scientific prospecting for low-grade and concealed ore bodies. Scarcity will increase the cost of metals and render practical their recovery from poor sources now considered uneconomic, possibly including sea water. With the exhaustion of "inexhaustible" resources and a new appreciation of the importance of metals, we shall see governmental limitations placed on the individual's right to exploit or use them for private gain.

F. H. POUGH
Curator, Physical Geology and Mineralagy

INSANE ASYLUM

DULL DIET, DESPERATION, AND A POPULATION PLAN

I believe that by A.D. 2000 mankind will have worked out the technical problems of food production far enough to permit the earth to support many more than the three billion then on it. Already we can produce enough yeast from an acre of sugar cane to supply the annual protein requirements of over 100 persons. However, I am convinced that wherever a country's entire population is being forced to eat little except such unpalatable foodstuffs as yeast "steak," algal "butter," and wood "sugar" in order to stay alive, we shall see vigorous steps taken to reduce the population to a level where the available land can support it on more appetizing foods.

RICHARD H. POUGH
Curator, Conservation and Use of National Resources

CHANGE AND GROWTH THROUGH UNDERSTANDING

Our task is to bring into moving equilibrium our knowledge of the physical world and our special knowledge of human beings. This involves learning how to bring to the study of human beings our full humanity, how to include the observer within the observational situation. To do this we need to orchestrate studies of human behavior from many different civilizations, so their historically developed insights may each contribute some of the hypotheses essential to a scientific understanding of mankind. Such a method generously employed should lay the groundwork for a world civilization capable of change and growth in an increasingly understood universe.

MARGARET MEAD
Associate Curator of Ethnology

BROTHERHOOD THROUGH SCIENCE, ART, AND MUSIC

I predict that the growing need for international understanding will lead to the development in New York City of an entirely new type of institution for the presentation of cultural and scientific subjects. Enjoying the broadest foundations, this sister to the United Nations will embrace the arts, history, health, and science and will include the portrayal of opera, symphony, folk dances, and choral programming. Through it, audiences will be placed in the environment of each country around the world and be able to hear, see, and feel how other people live. I predict that such an institution will have a large share in promoting better understanding among the peoples of the world.

GORDON ATWATER
Chairman, Astronomy and the Hayden Planetarium

A NEW PARTNERSHIP BETWEEN SCIENCE AND EDUCATION

The half century from 1850 to 1900 was characterized by an attempt to gain scientific understanding of the physiology and origin of man. Since 1900 there has been a scientific approach to the psychological processes of man. The next half century must see the scientist concerned with the extension of his science to include the improvement of man as a social being. Therefore, for the first time in history, the scientist and the educator must progress along the same road, side by side, in mutual recognition of the fact that science not only extends the world but is essential to its welfare.

CHARLES RUSSELL
Chairman, Department of Education

Drawings by Paula Hutchison

It's for You to Choose

We think of 50 years as a long time. On Earth's great timepiece, it is a second. But there is a sundial that says: "It's later than you think."

Once, long before man, it was *size* that counted. A little animal only a foot long, which has been popularly called Leaping Lena, founded a dynasty of giant creatures that could reach leaves three stories above the ground.

If we could have watched the growth of the dinosaurs through 140 million years, we might have believed that size and strength alone were most desirable for success. But Nature had something else in store—something that was to wipe the giants from the earth, almost as if they had never lived.

It became common for a small animal to win over a large one. In a limited sense, the meek inherited the earth. Actually, a better nervous system was evolving. Evolution was laying the foundations for the creature that talks, laughs, plans, and calls himself master of the world—the creature that invents, chooses, and learns from books—the creature whose mysterious desires can bring him close to God and whose pride can cast him lower than the beast.

This creature shivered his way through half a million years before he discovered how to make fire. It took him almost as long again to make a good machine to put it out.

Evolution teaches that three things are necessary to produce change—Variation, Selection, Transmission. If all of Leaping Lena's children had been alike, there
could have been no change. But anyone who has rais
dogs knows that there are variations in every litter.
the wild, some young are better able to survive the ha
ards of life—are stronger, swifter, more gifted in t
arts of concealment. So a process of natural selecti
takes place. The ones better fitted to meet life's con
tions are more apt to survive to maturity. And so
that reach maturity are more likely to secure a mate, pr
duce their kind, and transmit their effective traits to t
next generation.

There is a comparison between this kind of evoluti
—organic evolution—and cultural evolution.

The difference is that cultural evolution refers to
the tools that man uses and all his laws and social i
stitutions. These are not passed on by heredity b
chiefly through books and spoken tradition.

In cultural evolution, *invention* plays the part of *va*
ation. Choice takes the place of *natural selection.* A
a lot of things that might be bunched together und
"*education*" take the place of *transmission* and ke
alive the tools and customs we judge desirable. Th
form the design for tomorrow. The design is the he
tage we leave our children.

So we have Invention, Choice, Design.

Speech was the first great achievement that put m
on the road to cultural evolution. It permitted the tra
mission of powers from parent to child without here
ity. Written language greatly quickened the proce
because it took the burden off memory.

Man now has a multitude of machines to help h

ı Editorial Written on the 50th Anniversary of Natural History Magazine

d *new* machines. He even has electronic "brains" olve mathematical problems.

ı the last 50 years, science has given us the motion ure, the airplane, radio, poison gas, television, radar, ɔropulsion, atomic power, antibiotics, and the tools ıacterial warfare.

ı the next 50 years, science will give us things that prolong life and things that will shorten it; things will appeal to your highest nature and to your low- But no one can tell what the world will be like, ıuse it's for you to choose.

Ve are beginning to see that our skill in choosing far behind our inventive talent. We find ourselves ing a 100-mile-an-hour car with a 10-mile-an-hour ring wheel.

Vhether we shall spiral upward or downward will end upon this process called Choice. As long as e is freedom of judgment, it is up to you to choose. ntists will help us beyond their role of inventing testing new paths. They will advise. But the choice t be yours.

ocused on this vital act of choice are two powerful es. One is the creed that Might Makes Right. The r is the belief that the Strong Shall Help the Weak. feeds on hate, the other on love. One is destruc- , the other creative. One breeds strife, the other ce. They are at opposite poles. You can't very well eve in both at the same time.

cience will give us miracles. We shall need also the acle that raises us above our creature origin. Science can plant two seeds where there was one. So can the thief grow more vicious, the larger the loot.

It tires man to fix his calendar to the seasons and his timepiece to the stirring of life in a tiny cell. The wheels can be spread on the laboratory table, but who can yet put them together? We plant the seed in the field and then must wait, obedient to natural law. Before God, can we show surprise if, after sowing atoms and confessing no regret, we are to reap them?

We are all one with the earth and shall return to it. The slum-child pressing its cheek to the fresh grass. A man going home to the mountain.

Invention—Choice—Design. For good or ill, these are the handmaidens of our destiny. When Choice becomes Moral Responsibility, Invention becomes Inspiration, and the Design is full of Hope.

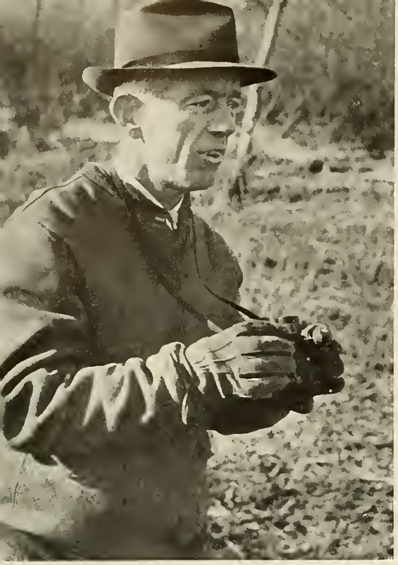
It's for you to choose.

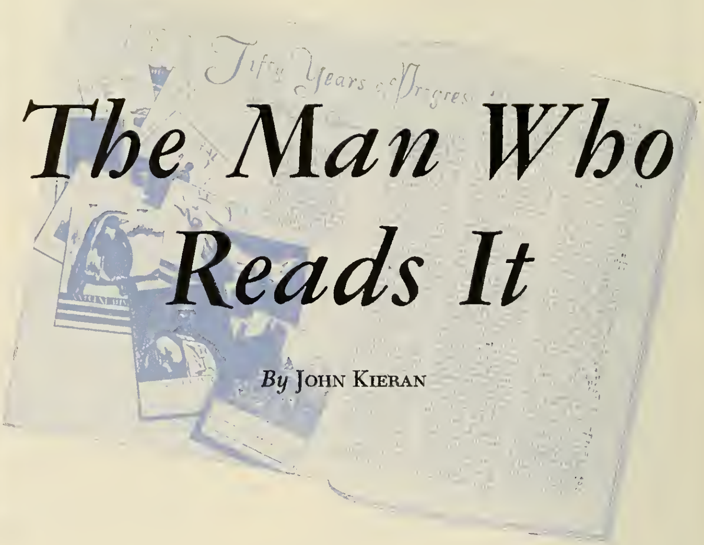
Two wars leave us in pain, and the world is sick. Black, white, yellow, red—each in his Maker's image; each exalted, each tempted. At home we deny our brother, while we add new strength to the old weapon. We were born in the day but have defiled our place in the sun. Those born in the night reach for our hand but do not find it; and a cloud rolls in, low over the earth.

Our brief time here has been a wedding of Hate and Power. In this union, dare we pray for the daughters of Love—Moral Responsibility, Inspiration, Hope?

Having brought ourselves to the edge of Eternity, dare we *not* pray for them?

EDWARD M. WEYER, JR.
Editor





The Man Who Reads It

By John Kieran

FIFTY years ago in New York City there occurred two events, one of which was noteworthy. That was the founding of Natural History Magazine at the American Museum of Natural History. The other, of somewhat lesser importance to the world at large, was my first intrusion into the halls of the same museum. Possibly the editors were even then editing copy or correcting proofs of the first issue of this magazine as I wondered along under escort of my father. But though I wrote a fair round hand for a boy of seven, I was not invited to contribute anything to the periodical that was about to be launched so successfully. I have been a regular visitor to the museum ever since that comparatively ancient day, and a constant reader of this magazine for many years now. I think the museum and the magazine have taken notable steps forward in the past fifty years, and it's a good thing, too, because the need for such a museum and such a magazine has steadily increased over this period.

Consider the drift in our population. There was a time when most of the inhabitants of the United States lived on farms. They knew Nature because they had to wrestle with it to make a living. They knew crops. They knew trees. They knew birds and animals. Weather was important to them. They lifted their heads to the stars on clear nights. Moonlight had social significance in the farming districts. Who pauses to look at the moon over Manhattan? Nearly 80,000,000 of our population are now classified as "urban dwellers" or, to be frank about it, city folk. This is the era of mechanical marvels. We have the assembly line in the factory and the push-button technique in the office. We are surrounded with so many mechanical aids and manufactured gadgets that we often act like mechanical men. We forget we are human beings. In our admiration—verging on adoration—of the electrified, streamlined, jet-propelled modern world of skyscrapers, television, stratospheric flight, and atomic energy in which we live, we are losing sight of the far greater immortal miracles of Nature that are all around us—from the tiniest drop of water that can be put under a microscope to the great stars in their distant courses, some of which dwarf not only the Earth by comparison but "our whole dinged solar system," as Bert Leston Taylor put it in his famous lines about Canopus.

Matthew Arnold wrote of Sophocles that he "saw life steadily and saw it whole." All too many of us can't take that broad view these days. We are trapped within walls. We have too many miles to go before we can get off paved streets and plant our feet on solid ground. Life in a big city is becoming a rat

Dear Editor:

It was with surprise and pleasure that I learned from your letter that my name had been picked at random from the thousands of Museum members and Natural History Magazine subscribers to tell why I am a reader of your splendid publication.

When, by chance, several years ago I heard of Natural History, I immediately subscribed because my son has always been a typical outdoor boy, wandering in the woods and being thrilled with his observations of wild animals and birds. I could write pages of his bringing home all kinds of animals found locally, and once he even raised a young hawk.

Natural History proved to be his most treasured magazine, for he has enjoyed it to the utmost and preserved every copy.

I always had only a normal, passive interest in nature, but I find that now, being an avid reader of Natural History, I am more conscious of the world of nature about me, and I am amazed at how much knowledge I have acquired and retained through the years about the peoples of this planet and the fascinating story of Mother Earth.

My son is now with the U. S. Marines stationed in Guam, and when his mother and sister and I have finished with each issue of Natural History we send it to him, for this is one of his most insistent requests. He has written us many interesting stories about wildlife there in the jungle. It is your magarace. The modern age is so marvelous that for most of us it's like the Looking Glass land into which Alice ventured, where the pace was so fast that the Red Queen warned Alice, "It takes all the running you can do to keep in the same place." We rush so much that we lose track of time. We concentrate so much that we narrow our vision. There is a wonderful world around us to explore and enjoy. That's the reason for the existence of the American Museum of Natural History. That's the reason for the publication of NATURAL HISTORY Magazine and the justified jubilation on the occasion of its fiftieth birthday.

In the museum and in the pages of this magazine we can and do travel far by land, sea, and air. We visit Africa, Asia, Australia. We take trips to the arctic and antarctic, with all the thrills of the explorers and none of their hardships. We look into the interior of the Earth. We find rare metals. We learn the cause of earthquakes. We go down to the depths of the ocean and see astonishing forms of marine life. We visit the tropics and see strange flowers and birds of almost incredible plumage. We look through a telescope and see a pin point of light that may be a star ten times the size of our Sun. We learn why we have eclipses of the Sun and Moon. We discover that the most adventurous of men lead humdrum lives in comparison with the fantastic careers of many insects. We are finally convinced that the largest living creature ever seen on Earth was not some scaled and tailed prehistoric monster that we know only through ancient bones or fossilized footprints on the sands of Time but a warm-blooded, seagoing animal that still lives and breathes in this modern age—the great Blue Whale.

: that has sharpened his eye for these
ıgs.

NATURAL HISTORY has another important
ıe to me personally, for, you see, I am
ployed by the Grand Rapids Varnish
poration as Finish Consultant and Stylist
Color, and I find your beautiful color
ers and your unusually splendid photog-
hy a help in my profession.

congratulate you upon the achievement
he fiftieth anniversary of your great mag-
ne and do hope that you will succeed in
cing it in many more American homes
ere it will be valued as a family educa-
ıal reference for many years, as it is in
home.

Yours sincerely,
D. J. BUCKLE
ınd Rapids, Mich.

How much all this means to others I have no way of knowing with accuracy, but it has been a great part of my own life. As a boy, I was always fond of hunting and fishing and camping, but it wasn't until I was out of college that I became deeply enmeshed in the delights of amateur ornithology. From the attic window of our house in the Bronx I could look out over the waters of the Jerome Park Reservoir. One winter day I saw that there were many scattered ducks on the reservoir. I borrowed a pair of field glasses, sneaked along the iron fence that circled the reservoir, and looked over the ducks to identify them. Some I was unable to identify until I went back to the house and peered into my Chapman's *Handbook of Birds of Eastern North America.* I saw fourteen species of wildfowl on the reservoir, and the group included one white-winged scoter, some canvasbacks, a few redheads, and a hooded merganser.

At the Bronx Zoo that winter I met a man who had a way of getting bird notes into a column in the N. Y. *Evening Mail,* a newspaper now long out of print. I induced him to go with me to the reservoir to see "my ducks," and in due time their presence on a reservoir in New York City was made known in a paragraph on the editorial page of the *Evening Mail.* That brought some visitors from the American Museum of Natural History to look over the duck situation in the Bronx. I encountered two of the museum men on my rounds and told them I was keeping a daily watch on the coming and going of the various species. They nodded approvingly. To this very day I feel a little proud of those nods of approval, because the two men from the museum were Charles Rogers and Ludlow Griscom!

Some months later, when Dr. Rogers saw how deeply enthusiastic I was about birds, he asked me to go with him to the meetings of the Linnaean Society of New York at the American Museum of Natural History, and he very kindly put me up for membership. Nobody arose to oppose the nomination, and I was duly elected. I have been a member of the Linnaean Society ever since.

I often felt like one of the conspirators in *Julius Caesar* as I hurried along 77th Street in the darkness, turned at the driveway leading to the brooding old building, slipped under the dark archway, and whispered the password "Linnaean" to the challenge of the uniformed attendant at the door. It was a thrill to attend those little gatherings of long ago, but it is a much greater thrill now to walk through the spacious halls of the new wings of the museum and see the marvelous habitat groups of birds and animals, the antelope groups that might delude a visitor into thinking that he was on the African veldt, and the Pacific bird groups that lure the bird lover "on from island unto island at the gateways of the day."

As the American Museum of Natural History has expanded nobly and improved immeasurably, NATURAL HISTORY Magazine has made remarkable progress in the presentation of important and fascinating subject matter. What is offered in NATURAL HISTORY is the truth that is stranger than fiction. There are stories of scientific journeys to the ends of the earth. They are written by men who know their subjects

Continued on page 191

CAMO
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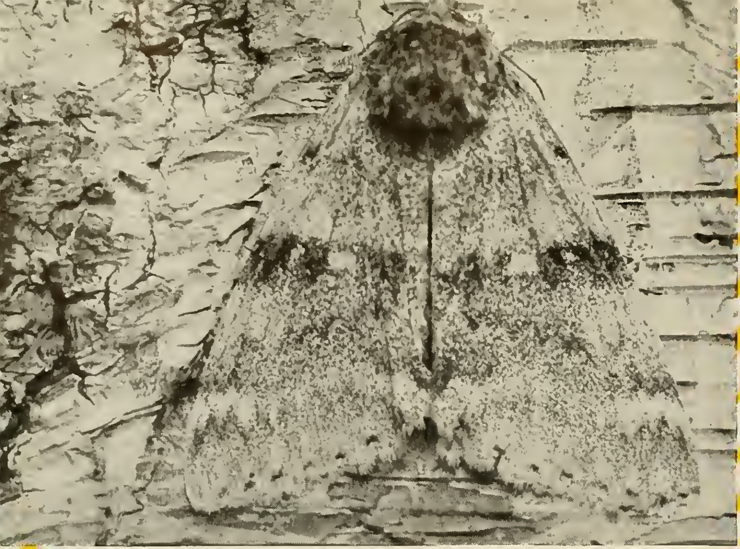


▲ THE OUTLINE OF THE WINGS in this moth (*Catocala relicta* Walker) is lost against the bark of the tree

The art of concealment makes many a weak creature strong in the struggle against its natural enemies

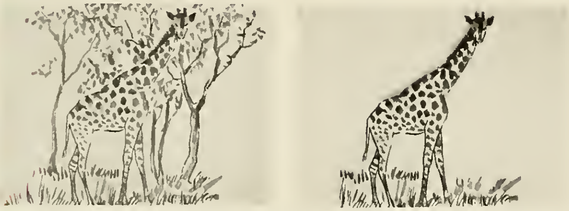
By LORUS J. *and* MARGERY J. MILNE
University of New Hampshire

Photographs by the authors unless otherwise credited

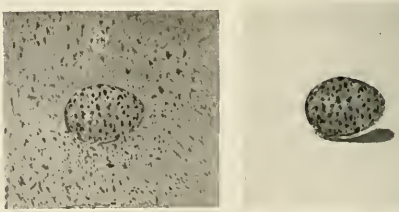
FROM the beginning of life on earth, all the varied creatures of the animal kingdom have had one objective in common—the need of finding a square meal. And since every creature is liable at one time or another to be looked upon as a possible source of food by some other animal, survival has depended upon various arts of concealment. We are all aware of the furtive tactics of a cat stalking a mouse and of the habit of the mouse to seek dark places and to enter openings too small for a larger animal. But nature has also endowed many animals with startling physical attributes that help them to escape notice—in short, with natural camouflage.

To be successful, camouflage requires that an animal blend so perfectly with its background or surroundings as to be indistinguishable from them. It is a means of concealment through absence of contrast. This lack of contrast may be in tone, in texture, or in color. Thus a killdeer's eggs on a bare sea beach, a rabbit crouching among roadside weeds, an underwing moth on a gray tree trunk, all challenge human vision. Usually each is passed unheeded—an unseen example of the protective resemblance so widespread in the animal kingdom. Each taxes the most observant eye and also the brain that interprets the eye's seeing. Each trick of camouflage has a definite survival value for the creature concerned.

Colors are so much a part of our everyday life that it is difficult to think of the world without them.



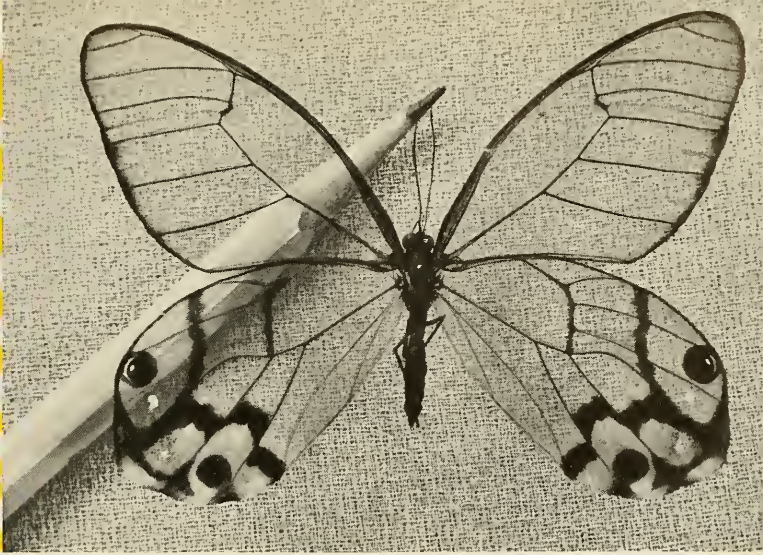
Against a confusing background of foliage, the spots of the giraffe look like patches of shadow and serve to hide the profile of an animal that is famous for its grotesque shape



A speckled egg is hard to see on a bare beach unless there is strong shadow: an example of protective resemblance

LAGE

ure



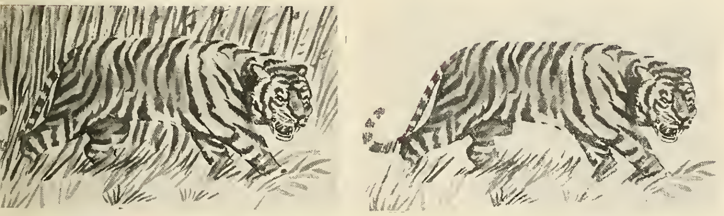
Ward's Natural History Est. photo

▲ The Glass-wing Butterfly (*Haetera piera* L.) from the American tropics is so transparent that it is hard to see in flight

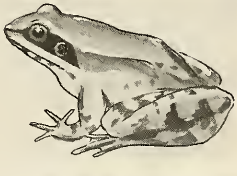
But as far as can be learned, we and the other primates (monkeys, apes, and their kin) are the only mammals that can distinguish the various regions of the spectrum except through differences in brightness. Birds, fishes, and insects may have good color vision, though different from ours. But among our familiar four-footed friends—the horse and cow, dog and cat, rabbit and guinea pig—we find no recognition of color. For them scenery, enemies, and mates exist only in shades of gray. How then do their eyes evaluate what we call camouflage? What is protective coloration to an animal that is truly color-blind?

For us, the landscape and its inhabitants consist of a kaleidoscope of multicolored patches—some light, some dark, most in-between. We depend upon our mental analysis of this patchwork when inspecting objects beyond our reach. Outlines, we conclude, must mark off separate parts. Sudden changes in color or brightness are portions of the outline. Gradual transitions suggest continued planes, while roundness and shadow-casting go hand in hand. We base each judgment on combined appreciation of difference in color and variations in brightness. Yet where this color sense is lacking, the same scene need not mean monotony. Only photographers dream up the extreme examples and point out that a white cat sleeping on an ermine coat spread under a noonday snowstorm (a "high key" picture) may be just as devoid of details as a black cat eating licorice in an unlit coal cellar at midnight (a "low key" picture). Both situations are extremes rarely met with. Neither involves color. But a green katydid imperceptibly quivering its green wings to scrape out its familiar calls on a dark night is no more contrasty on a green leaf when illuminated by a floodlight. To us it has color, but so successfully does it match the surrounding foliage that its vociferous presence may escape our diligent search.

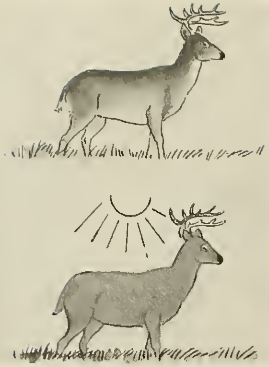
In spite of our ability to distinguish colors and the excellence with which our eyes identify delicate differences in tone or detailed pattern, our initial reactions to



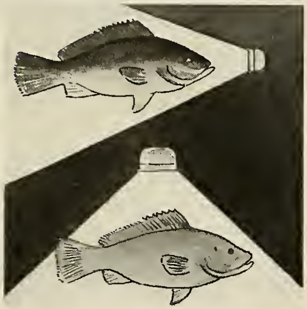
"Disruptive coloration" distracts the eye from the natural outlines of the animal and eliminates the silhouette. Thus the body blends into the background or appears to be broken into disconnected parts



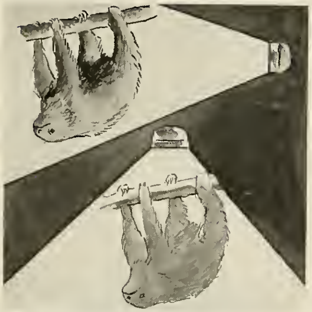
The frog's neat circle of an eye would attract attention were it not for a disruptive stripe of coloring that passes through the eye and continues along the head



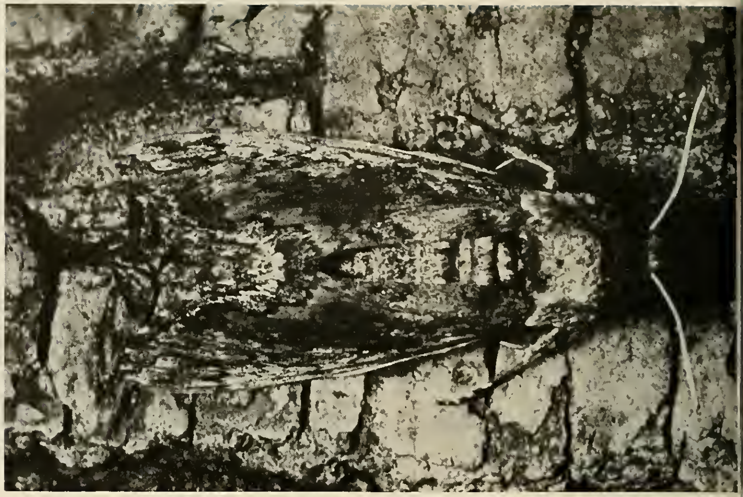
Sunlight brightens an animal's back and casts shadows on its underside. Hence, most four footed animals are lighter underneath than on top



A fish lighted from directly in front would also show this conspicuous distribution—darker above and lighter below. But with light coming from the normal direction, the body blends into the background



The sloth, because it lives its life upside down, is fortunate to have the usual pattern reversed



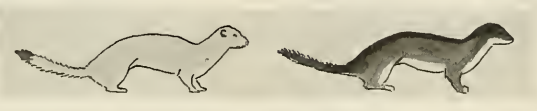
▲ ALTHOUGH CLINGING to the bark of a fallen pine tree in full sunlight, this large hawk moth went undetected until, in nervous response to the photographer, the insect raised its gray antennae. Previously these feelers had been hidden under the sides of the body

most objects are in terms of the most pronounced feature. This is frequently the over-all silhouette. At least one school of fashion design has insisted on student recognition of this basic fact in vision. Everyone has seen how easy it is to confuse new acquaintances when their silhouettes shift from street attire to bathing suit or evening gown. A witness to a robbery may know only that he saw a tall, thin man or a short, fat one. Of course, if the robber wore a bright yellow raincoat, that might be the most conspicuous feature. But even among our close friends, it is often the combination of silhouette and movement that allows recognition. "Yonder comes Antonio. I ken him by his gait."

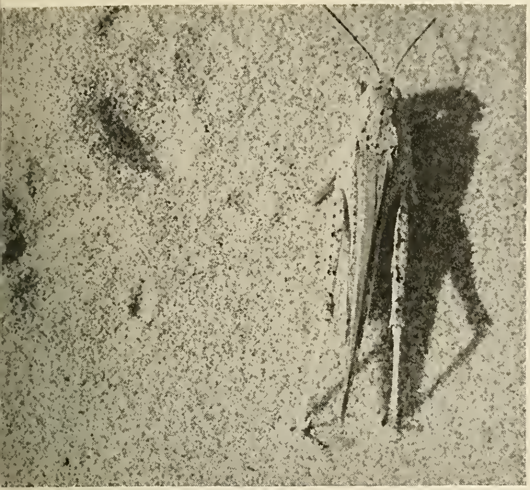
Birds against the sky often appear only in silhouette, but the naturalist knows them by their flight—the undulations of goldfinch and flicker, the ponderous rhythmic flapping of a string of pelicans, the V's of migrant geese. Insects too small, too indistinctly marked to be seen clearly at a few yards' distance, become hover flies, dung beetles, gnats, bees, caddis flies, or moths according to clues given in their gyrations through the air. This is high contrast—the opposite of camouflage. A silhouette must be destroyed for an animal to disappear. The various means employed all gain this end.

Disruptive Coloration

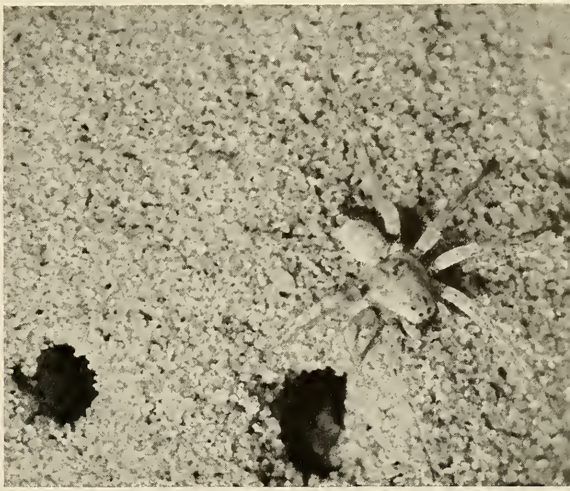
One effective means of concealment is based on distraction. On its body the animal may wear an irregular pattern of spots, stripes, or other markings that catch the eye and hold it, drawing attention to meaningless details and away from the creature's outline. This eliminates the silhouette, by means of which the whole might be identified. We call this trick "disruptive coloration." It serves to separate a single body into a series of seemingly disconnected, unimportant parts. A fawn in the spotty shade of an open woodland becomes a series of sunlit patches on a brown lump devoid of distinctive contour.



Many animals living in regions that are snow-covered part of the year undergo a change in their fur, like the weasel shown here



THIS GRASSHOPPER'S SHADOW gives it away, and the strong le lighting also shows up its footprints in the sand. In mid-y illumination, however, the insect hides its own shadow and nishes from view by merely staying still



▲ **PAUSING** near the burrows of the common beach flea, this pale, creamy-white spider could be overlooked more easily than found again. At night it can be located with less difficulty—but only because its eyes reflect the beam of a flashlight

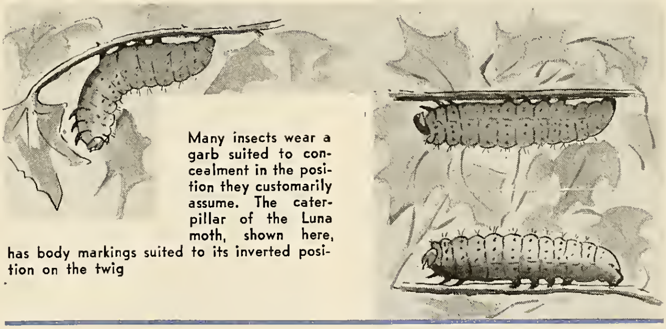
A badger crouching in a field turns toward you a face sharply marked in alternating vertical bands of cream and blackish-brown, and you tend to overlook the outline of the head itself. The coarse camouflage painted on military installations achieves its purpose in the same way. The marks may simulate a number of different objects—none of them clearly recognizable—and distract the eye from the true boundaries. The scaly, mottled color pattern of a water snake, the contrasty feathers of a killdeer, the wing markings of numerous moths and butterflies have this uncanny ability to confuse the eye.

Related to disruptive coloration is another type of pattern. The markings on an animal's back may be continued irregularly and across actual spaces onto thigh and shank so that the appendages merge as one mass when the creature is crouched in repose. Insect wings commonly carry the coloration from one pair to the overlapping set, and among moths the two front wings may meet to form a common contour. These methods introduce continuous disruptive bands and mottlings that bear no reference to the outlines of the separate appendages and serve to conceal the body parts. Perhaps the most spectacular of them are the devices that conceal eyespots. The neat circle draws attention, and a wood frog's eye would have an obvious iris were it not for a pigment stripe through it that continues the dark disruptive band along the amphibian's head. In many insects and fishes the very outline of the body itself is irregular—almost ragged—so that no clear shape stands out to distinguish the creature from its background.

Transparency

A few animals blend with their surroundings wherever they go because their bodies are so transparent that the eye sees through them as through so much cellophane. The Glass-winged Butterfly of the South American tropics is a classical example—one of the few on land. Animals that frequent upper levels of the sea are often diaphanous, such as jellyfishes. Some, like the early stages of the eel and a few prawns, achieve this clear quality in all but a few vital organs, yet they have firm bodies, good sense organs, and active habits. Whether at rest or in motion, these creatures are difficult to discover.

But transparency is difficult to achieve. It is far simpler to match a customary background composed of blended shades of gray or green or buff. Of course, the animal must then keep to the appropriate back-



Many insects wear a garb suited to concealment in the position they customarily assume. The caterpillar of the Luna moth, shown here, has body markings suited to its inverted position on the twig

◄ The ghost crabs that scamper over a sea beach vanish as soon as they stand still if the light is soft. But sharp shadows make them more conspicuous, and . . .

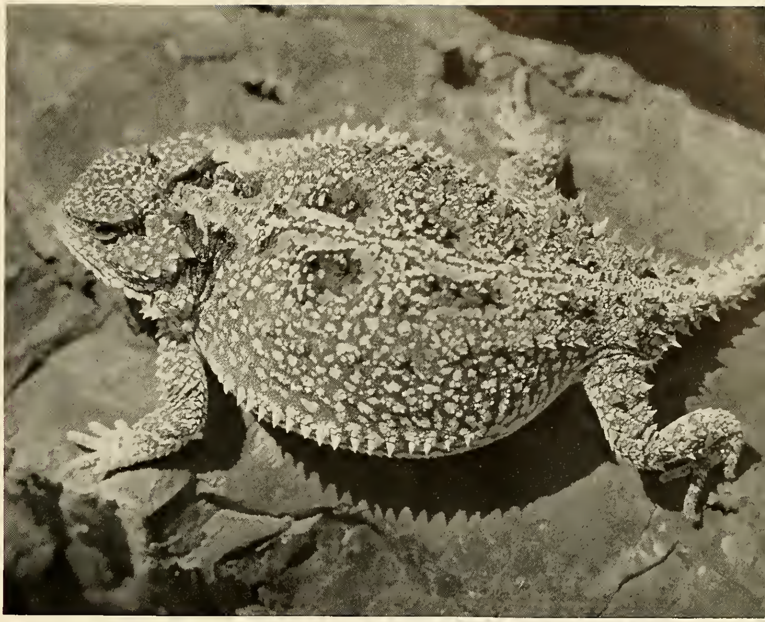
▼ . . . it is their habit to bury themselves in the sand until only the eyes show

ground if it is to remain safe. A green katydid on a scarlet poinsettia leaf would be almost as conspicuous to us as a crow on a snowdrift. The katydid must stay among *green* foliage to escape animals that have color vision. Even a brown, leafy background would destroy the illusion. The pale tiger beetles, the grayish-white spiders, the ghost crabs that scamper over a sea beach vanish as soon as they stand still. Beebe referred to them as "autochthones . . . that . . . drifted about like sand-grain wraiths . . . And when they did move, recognition usually came too late to some fly, which had trespassed on this littoral hunting ground."

The degree to which an animal matches its background is sometimes spectacular. One of the most famous areas where this can be strikingly observed is within a few miles of the site of the first atomic bomb test, in the White Sands National Monument, near Alamogordo, New Mexico. On this strange series of glistening gypsum dunes grow a few yucca plants and a scattering of other herbs. But types of lizards and even insects that are dark in color on land immediately surrounding the White Sands National Monument are represented on the gypsum by white individuals. These scamper from clump to clump of yucca or alight on the dunes and disappear by camouflage.

Even the New Mexican pocket mouse, *Perognathus intermedius,* displays this extraordinary lack of coloration. The individuals on the sand are almost pure white, though they are not albinos since their eyes are black. Those on surrounding rocky soil—the normal habitat for this little rodent—are brown. And close by, on black beds of lava deposited in the not-too-distant past, a third color phase of this same pocket mouse is uniformly blackish except for the pale paws. Other than in their color, no differences have been detected between these representatives of the same species. Like the distinctive grasshoppers that click in the air over each of these three types of terrain, each has achieved an almost perfect match for the very different types of background. The relatively recent origin of these dunes and lava beds gives us pause. It indicates more rapid adaptation in the animals there than might be supposed possible from other illustrations.

Difficulties still confront the animal that duplicates its environmental background. Sunlight brightens its back and casts shadows below its body. To compensate



➤ THE HORNED TOAD'S sawtooth shadow is very conspicuous here. But in its sandy domain it buries its fringes so that shadows and underparts disappear

for this inequality, countershading has developed on many animals. Their backs are darker than the surrounding landscape, and the shine of sunlight there provides no warning clue. Their bellies and flanks are pale, but because these parts receive less illumination, they reflect a matching tone. When you look down upon the black or brownish back of a fish in deep water, it is barely visible against the background, whereas its silvered belly will show a minimum of difference to eyes looking skyward from below. The sides are gradually countershaded, thereby reducing visibility from the side. Only when such a fish swims over a sand bar does it become obvious. Then it stands out sharply from the bottom for any kingfisher to see, while the added light reflected from the sand brightens its undersurfaces until they, too, no longer match when viewed from any angle.

Solely in customary surroundings and illumination is countershading effective. Conventional positions for the body are required also. And animals that regularly spend their lives inverted, like the sloths in tropic trees, are usually pale along their backs and dark over the surfaces they hold toward the sun. The same arrangement is seen among certain bugs, as for example in the back swimmers (*Notonecta*) and in the small crustaceans known as *Scapholoberis*. Often an upside-down habit can even be predicted simply from the examination of such a creature. Thus the Luna and many sphinx moths have caterpillars that are dark green along legs and undersides and pale greenish-white along the back; and if you watch them, you will see that they *do* cling below the leafy twigs on which they customarily browse.

Shadows

A creature that matches its background perfectly may still be obvious on a smooth stretch of sand or a clean tree trunk or leaf, because its shadow traces a telltale black outline around one side. Ghost crabs on a beach would often be almost invisible as they rear high on eight bowed legs except for the conspicuous shadow they cast. Artists often employ shadow lettering in advertising copy, and we read the word that isn't there. The shadows alone enable us to imagine the raised letters. To eliminate its shadow is therefore part of an animal's problem in self-concealment.

Perhaps the simplest way that animals hide their shadows is by squatting or lying at full length on the smooth surface—spreading their bodies and pressing flattened edges against the terrain. Horned toads bury their fringes under the sand, so that shadow and underparts disappear together. The badger's broad, flattened body helps it vanish in a field. Moths on bark employ the same procedure. Ghost crabs quickly twitch their legs and sink their bodies and appendages into the beach until only upright brown eyestalks remain exposed to watch pursuers pass them by. A few lizards and fishes even have extra frills along the sides of the body and tail, which spread out on any supporting surface and eliminate shadows.

In spite of perfect countershading and shadow elimination, the change of seasons can upset camouflage. Thus the snowshoe rabbit must be white in winter and brown in summer. The weasel that follows the rabbit fears the hawk, and except for a jet-black tip to the tail, it turns to ermine white when snow begins to fall, then to an earthy brown when the spring sun melts through to the ground again. The transition periods may be dangerous ones but not for the ptarmigan, whose feathers provide perfect matching throughout the year. In winter, every feather is pure white, but as rocks and moss begin to project through the snow, little patches of brown feathers appear in the plumage. The last few white feathers are shed as the snow vanishes. The reverse sequence protects the

SHADOW
SHADOW

Shadow alone can serve as identification

ptarmigan in the fall. Such changes are needed where seasons are so different. But in Florida and other snow-free states, rabbits and weasels replace their summer fur with winter pelage of the same brown color.

The advantages of matching a background in tone are evident even after dusk, when day vision ends. Color is no longer operative: "At night all cats are gray." Yet owls and other night hunters recognize their prey by sight as well as by sound. A contrasty target scampering across a starlit field is far easier for them to catch than the same sized object camouflaged to match the terrain. Scientists at the University of Michigan tested this in the laboratory and showed that white mice on dark loam or black mice on pale sand lost their lives to a hungry owl long before the ones that suited their background.

The less distinct the contrast between an animal and its background, the closer a naturalist or enemy must come in order to detect its presence. The accompanying diagram demonstrates this principle.

Another way of expressing it is to say that the ability to discriminate contrast depends upon the proportion of the total scene that the object occupies in the observer's eye. Thus if an animal is farther off, it does not need to match its surroundings quite so faithfully to escape detection. Even a large number feeding together in the distance blend sufficiently to disappear.

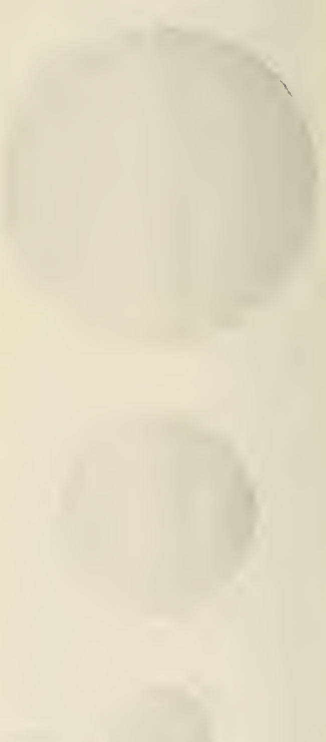
A striking example of the opposite effect is provided by the Texas bluebonnet. In spring, when carpets of this handsome lupine stretch to the horizon, open woodlands take on a new and startling depth. Under the trees the soft yet brilliant blue extends into far vistas. Perspective shrinks the upright trunks to matchstick dimensions; the bluebonnets go on and on like an azure sea. Yet only a week before, the green of lupine leaves and buds blended with the green of the trees to hem in the scene. The lack of contrast and the loss of detail through distance gave no notion of how far the eye could see. The yonder, without bluebonnets, had disappeared through camouflage.

The Texas scene is a revelation that depends upon color vision. No black-and-white photograph shows the effect adequately. However, many creatures do not possess color vision, and the role this ability plays in natural camouflage lies beyond the scope of the present article.

Control of Pigmentation

Still another type of camouflage is found in certain fishes. In the surface layers of their skin are star-shaped cells containing pigment. In some, most of the pigment is black. This is the case in those common little catfish known as bullheads or mudpouts. The pigment is under nervous control and can either be collected together in the middle of each cell or spread out into the many branches. If concentrated, the tiny black dots can be seen only with a microscope, peppered at intervals over the fish's body. The pinkish-whiteness of the skin shows clearly, and the over-all effect is white. But if the pigment is dispersed, it renders the whole exposed area of the cell a deep black. The overlapping extensions of the many cells effectively cover the body surface, so that the over-all effect is black. The change from concentrated pigment to dispersed pigment may require less than a day. It depends chiefly on what the fish sees. If a mudpout is placed in a black tank, it, too, soon becomes black. If another mudpout is in a white tank, it becomes white. If both are now transferred to a gray tank, both adjust themselves to match the new environment.

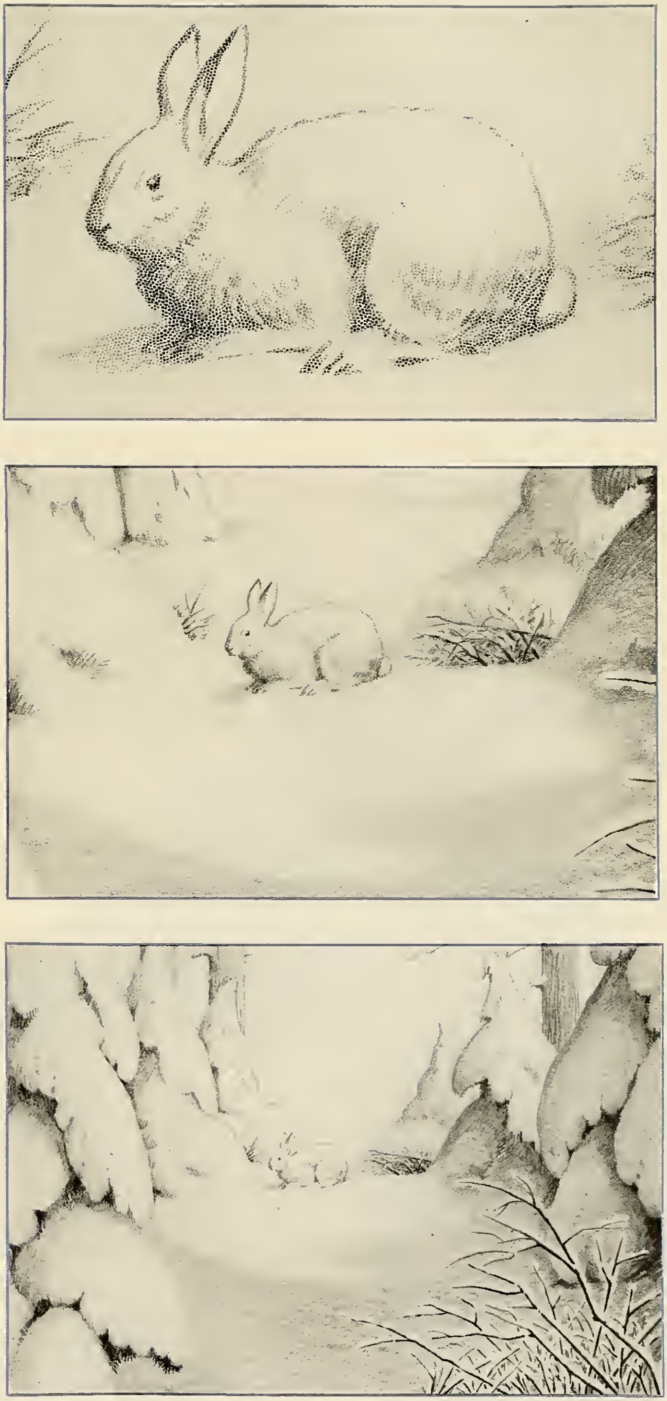
Perhaps the ultimate in this direction is the ability of the flounder and its flatfish relatives, the turbot and halibut. These fishes lie on the bottom, on what originally was one side of their bodies. The young fish has a more normal shape, but one eye migrates to the upper surface as the fish grows. This, together with a strange twisting of the mouth, allows the fish to operate in a seemingly lazy position. But again the eyes and pigment cells on the upper surface are intimately related. Unlike the mudpouts, however, a flounder has in addition to black pigment, a white, a yellow, and a brown—all in an irregular pattern. And not only are the dif-



When there is little contrast, the size of the object determines whether you will be able to discern its outline. Note the comparative ease with which you can distinguish the two halves of the larger circle, and the increasing difficulty as the circle becomes smaller ferent colors under individual control, but even the areas of that uppermost surface are regulated separately. Thus if a flounder is on a sandy bottom, the over-all tone of the pattern matches the brightness of the sand—whether white coral bottom or muddy gray sand or black volcanic particles. The pattern of the pigment also matches the coarseness of the sand by being very minutely speckled. If the flounder is on gravel bottom, on the other hand, specklings on the back are coarser.

The ability of the flounder to match the background seen with its misplaced eyes was investigated by the late Professor F. B. Sumner at the Scripps Oceanographic Institute in La Jolla, California. He placed the fish in special tanks with linoleum patterns for background and recorded photographically the accuracy with which the creatures matched the sequence and coarseness of the squares of black and white on which they lay, quietly waiting for food to swim within capturing distance. If the fish moved, its pattern soon adjusted to the new locality on the linoleum. If transferred to a tank with a different bottom design, the body pigment cells performed again.

A person can but wonder how many thousands or millions of generations were required for these various complex adaptations to reach their present perfection. A slight advantage in terms of survival must have been the test of their permanence, for the less effectively hidden individuals were not so likely to live to produce their kind. Of course, camouflage alone is not enough to guarantee success in the struggle for food and mates. In fact, it would be disastrous for an animal to be so well concealed that its mate could not find it! Yet among the many curious ways in which animals are adapted for success in life, camouflage is one of the most fascinating. It is also a study in which a great deal of valuable information can be added by interested observers.



Since apparent size is dependent upon distance, an animal does not need to match its background so closely if it keeps far from other creatures

THEY stood browsing among the acacias, their spotted, sinuous necks arching above the trees. Gray tongues, wet and serpent-like, sought out the freshest, tenderest leaves and tore them from the branches. Tufted tails switched languidly from side to side. Even though my car was now only 200 yards from where these animated skyscrapers were stripping their lunch from the trees, they seemed entirely unaware of my presence.

The scene had an air of unreality about it, a stark sort of unreality that sprang, oddly enough, from familiarity. Although I had never laid eyes on the spot before, I knew it as well as my own street and number. It was a museum diorama come to life, and I had seen it in replica a hundred times before, as it waited eternally for the subtle touch of life.

Now, here before me, it breathed and moved and whispered – the golden infinity of Kenya's Athi Plains, the parasol-topped trees with their sparse, thorny foliage, the zebras, the wildebeests, the "Tommies," and – the giraffes!

The giraffes were hardest of all to accept as living flesh and blood. Yet there they stood, placidly munching away on acacia leaves with no inkling of the awe I felt.

Giraffes had long been favorites of mine in the San Diego Zoo, ever since, in fact, we had received our first pair in 1938. I had seen giraffes in circuses and other zoos before, but, when our own zoo specimens emerged from the crates in which they had been shipped from Uganda, I felt certain that nowhere in creation could there be two more beautiful creatures than these, smudged and travel-weary though they were.

I marveled at their towering height and the fluid grace with which they glided in their pacing gait; at the quiet dignity with which they accepted the first uncertain ministrations of their new keeper; and perhaps most of all at the disarming, soul-searching quality of their gentle brown eyes. My reaction was an immediate attachment, and it is one from which I have never recovered. The novelty of having a pair of giraffes in our own zoo soon wore off, but the affection and interest I originally felt for them has grown conversely, multiplying many times over with the birth of each new infant calf to the adult pair.

The same attachment, I found, held true for the wild giraffes in Africa. Unconfined by museum glass or zoo barricade, they were more amazing, more wonderful than ever.

The first group I saw was a small one, just inside the gate of Nairobi

◀ THE GRACEFUL GIRAFFE lives peaceably with its kind and bears no ill-will toward other types of animals. Its disarming, soul-searching, gentle brown eyes endear it to the zoo keeper, though it can "kick in all directions at once"

Photo by Quentin Keynes

HIGHBOYS

Meet the incredible giraffe — an animated watchtower that has difficulty coming down to earth for a drink and sometimes lets its curiosity get the better of it

By Ken Scott, Jr.

General Curator, San Diego Zoo

Photo by Quentin Keynes

▲ **Silhouette of Africa: giraffes browsing on the Athi Plains in Kenya Colony. The tallest living animal symbolizes Africa more than any other big game animal, for nothing like it roams any other land**

National Park on the Athi Plains. There were four of them: a bull, two cows, and a half-grown calf; and I came upon them while they were in the midst of their lunch (both figuratively and literally speaking). They fed from the crown of the same tree, spaced at intervals around it like any family foursome about the dinner table.

Behind them in the distance lay the outskirts of Nairobi itself, and only a few hundred yards away traffic bustled up and down the busy Magadi Highway. The proximity of civilization had little apparent effect on them. It was obvious that the protection they had enjoyed for a number of years had won their confidence to an astonishing degree.

As my car crawled toward them, they paused in their feeding from time to time, rearing their heads briefly before resuming their meal. Their curiosity was at first quite casual and only momentary. But as I drove closer, they watched more and fed less. Finally, with an air of, "Oh, well, we were through eating anyway," they sauntered off.

A short distance away, they stopped and turned and stood watching me. Patiently, they chewed their cuds and awaited my departure with a concern that was due more to annoyance than to fright.

As often as possible during my stay in the Nairobi area, I drove out to the park, which, conveniently enough, is situated only a few minutes from the center of town. On each occasion, I found the same giraffe family, and they were never far from the acacia clump near the park entrance. That first meal was not the only one I interrupted, but sometimes my visits were more conveniently timed. I often saw them in the open, half asleep and drinking-in the morning sun, and sometimes I came upon them standing in the road.

Fortunately both for them and for the motorists, the speed limit in the sanctuary is fifteen miles an hour, a pace that gives the giraffes ample time to make a graceful exit. On the open highway where speed is unlimited, giraffes constitute a considerable hazard, particularly at night.

I was to see many giraffe herds during the ensuing weeks, but I never came upon a group without experiencing that initial reaction of combined awe and incredulity. I am still almost ready to agree with the man who insisted, "There ain't no sech animal!"

The giraffe observations and notes I had opportunity to record in Africa could in no way be construed as scientific studies. But in reviewing them, I find that, sifted and unscrambled, organized and digested, they do perhaps provide a key to the character and behavior of this unique creation of nature. Certain traits, I find, are referred to over and over again, so repeatedly in fact that one cannot help drawing certain general conclusions. And of these traits, the giraffe's *laissez-faire* approach to living tops the list.

There exists no less offensive a beast than the giraffe. It lives peaceably with its kind for the most part and bears not the slightest degree of ill-will toward other kinds of animals—both of which, as character recommendations, are more than can be said about the majority of people! Yet despite such inoffensiveness (or perhaps because of it), the lofty giraffe is sometimes an underdog. Because of its size, its enemies are naturally few in kind, but what they lack in variety they make up for in violence—and Man heads the list.

For some unaccountable reason, the giraffe is a favorite of trophy hunters. Its head, stuffed with papier mâché and a pair of glassy, expressionless eyes, decorates many a sportsman's den—and I use the word "sportsman" loosely, since walking up to a giraffe in the field and dropping it in its tracks must involve all the excitement and danger of bagging a Jersey heifer in a dairy yard.

Both the lion and the leopard occasionally kill giraffes, but they do it merely to appease their hunger. A single giraffe can provide a hearty meal for an entire pride of lions as well as the jackals, hyenas, and

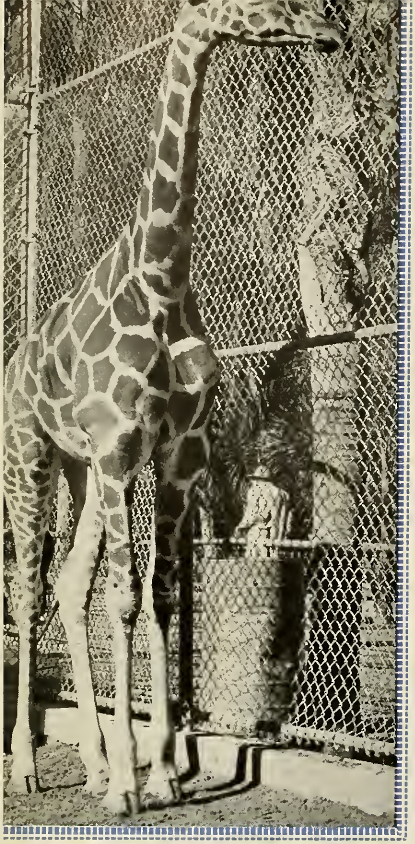


Photo by G. E. Kirkpatrick

▲At zoos the giraffe is always a favorite attraction. The animal is well known for its curiosity about everything, including people

vultures that move in as soon as the big cats have eaten their fill.

A giraffe has no means of defense unless, as one zoo worker put it, you say it is the only animal that can kick in all four directions at the same time. While this statement is a slight exaggeration, it is nonetheless true that anyone working with a giraffe in captivity had best keep an eye on its hoofs or he is likely to be reminded of them in a most disconcerting manner. In the wild, a hunter never gets close enough to a giraffe to be in a position to worry about being kicked.

The giraffe's horns, small, knob-tipped and hair-covered, are of little value in defending their bearer against predators. To my knowledge, the only use to which they are put is in the occasional combats that occur between two males. At such times, one male lowers his head and shoves his horns between the forelegs of the other. Then, with a mighty heave, he rears his head, attempting to throw his adversary back on his haunches.

The long neck of the giraffe, incredible though the contention may seem, contains exactly the same number of vertebrae that grace the human neck. There are seven of them, but the degree of their elongation is without equal, and they serve their bearer in good stead.

The giraffe's neck constitutes a watchtower. This, combined with excellent vision and a good sense of smell, enables the animal to observe potential danger from a considerable distance. Unfortunately, the giraffe's judgment as to what constitutes potential danger and what does not is poor. Being cursed with an innate and irrepressible curiosity, the giraffe is often attracted by something that should scare the living daylights out of it.

This foolhardy characteristic is particularly evident in young animals. I have watched a mother giraffe pace excitedly back and forth while her precious calf edged closer, step by step, to where I stood motionless. No amount of snorting or head tossing by the alarmed parent had the slightest effect on the youngster, and only some slight but sudden movement on my part sent it rocking home to mother.

Among the most remarkable habits ascribed to the giraffe is that of the communal nursery. Some authors discredit the story entirely, describing it smugly as an old wives' tale. However, I have seen a single, mature giraffe cow surrounded by as many as nine youngsters, all under a year old—with not another adult giraffe within a mile in any direction. The gestation period of a giraffe is approximately fifteen months, and only one calf is customarily born at a time—never more than two. Since "novemtuplets" would be entirely out of the question, the only explanation I can offer for such an aggregation is the communal nursery theory.

Giraffes are generally sociable animals, with only an occasional misfit who appears to live alone and like it. Giraffe herds may include anywhere from half a dozen individuals to a hundred. The largest herd I observed consisted of approximately seventy members.

This group was led by a magnificent, black-spotted bull. His neck was thick and muscular, and his forehead bulged with the protuberances that characterize most mature giraffe bulls. There were several other bulls in the herd but not one that even began to rival him in height, bulk, or coloration.

Yet impressive though this monster was, he was still not the most noteworthy member of the herd. That distinction belonged beyond doubt to a small and rather puny individual.

It was an albino, with reddish and poorly defined spots and interspaces of dusty white. Because of its poor vision, the albino always sought the center of the herd, apparently depending upon the behavior of the other animals to warn it when danger was imminent. Try as I might, I could not approach it closely enough to obtain a satisfactory picture. Invariably it was surrounded, and sometimes completely hidden, by its herdmates.

The herd permitted me to walk within 300 or 400 feet of its outermost member. At this distance, however, the entire group began to move away. The retreat was executed not hurriedly, not nervously, but with a leisurely dignity. Only the leader remained steadfast, standing broadside and outlined against the sky like a massive statue. Finally, when he appeared to be satisfied that his compatriots had retreated to a safe distance, he too walked sedately away, serving as rear guard.

Giraffes are strictly browsing animals, feeding from the tops of acacias and other trees and shrubs of a convenient height. Their table manners are beyond reproach and quite in keeping with the graceful behavior that generally characterizes them. Drinking, however, is another matter.

When a giraffe drinks, it is forced to toss both grace and caution to the winds. In lowering its head to the water level, it becomes the ultimate in awkwardness. Sometimes it spreads its forelegs, stiffly and straight, at right angles to one another, and shifts its front feet farther and farther apart in shuddering jerks until at last it can reach the water. At other times it places the feet slightly ahead of the body and bends its forelegs forward and down, spider fashion, until the head is low enough to reach the water. In either case, the process is a slow and uncertain one. And once the animal's thirst is slaked, the recovery of its normal standing position is just as awkward.

Consequently, the giraffe is understandably reluctant to visit the water hole and does so only when it is absolutely certain that no danger lurks near by. If some strange scent disturbs the giraffe as it approaches the water hole, it refuses to drink until the scent is gone or its thirst becomes unbearable. It subsists in the meantime on what scant fluids it can glean from its food. Like the camel, the giraffe has been accredited with remarkable powers of abstinence. It can forego drinking for 40 or 50 days, or so the story goes! Such reports come under the heading of gross exaggeration, but it is safe to say that the giraffe may, and often does, go several days without water.

Of all the myths concerning the giraffe, that which is most commonly repeated and most widely believed is that the creature is mute—that it lacks any vestige of vocal equipment. This is far from the truth, for the giraffe does have a larynx—a poorly developed and seldom utilized one, to be sure—but still a larynx. So far as I know, there are no authoritative reports of the vocalizing efforts of wild giraffes, but zoo specimens have been heard to "moo" softly. Thus, as Mr. George G. Goodwin of the American Museum has been quoted as saying, the giraffe is not mute, it is merely reticent.

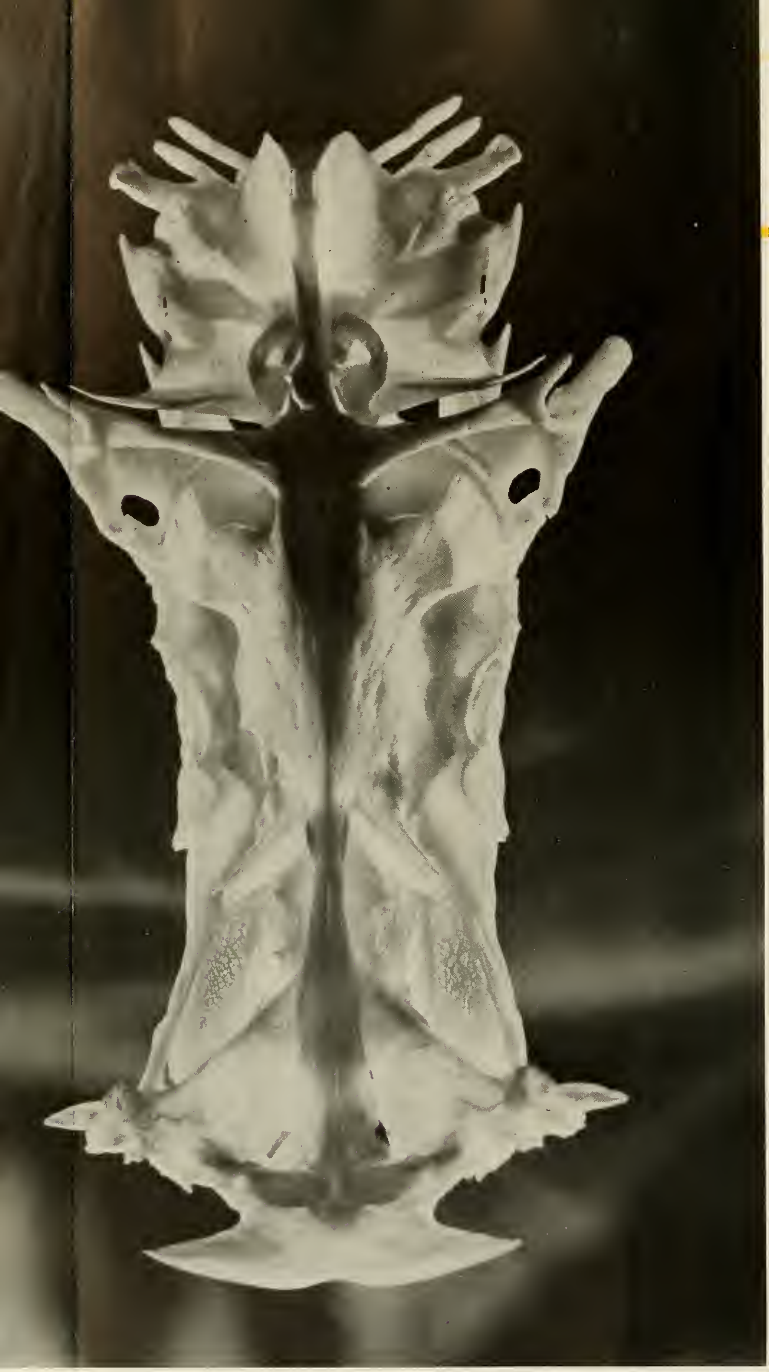
There are several easily distinguishable types of giraffe. There is the Masai giraffe, with its brown maple-leaf blotches against a background of beige. Then there is the reticulated or Somali giraffe, with its red coat and network of immaculate white. And the Uganda giraffe has three bony protuberances in addition to the two bonafide horns, which have caused it to become known as the "five-horned" giraffe. Each of these and half a dozen other described forms have some individual claim for physical distinction. But whether the various forms are merely local races or constitute valid species is a matter worthy of considerable research.

The problem, however, is one that concerns only the taxonomist. As far as the African tourist is concerned, a giraffe is a giraffe, and nothing else matters. Here stands a creature that symbolizes Africa perhaps more than any other of the Dark Continent's big game mammals. Nothing like it roams any other part of the world. It is and has been, throughout historic times, confined to Africa.

The late Martin Johnson, in selecting a color scheme for one of his amphibious planes, chose a giraffe-hide pattern. The choice was not the result of a mere whim. The plane was to be christened "The Spirit of Africa," and what design could be more appropriate than that of the giraffe!

▼ A UGANDA GIRAFFE with her newborn calf. The female bears only one calf at a time—never more than two

Photo by G. E. Kirkpatrick



▲ THE REPLICA of the crucifix, complete with halo, is on the underside of the skull. Venerated for centuries, these skulls are sold in curio shops around the Caribbean. The authentic dissections from which these photographs were made represent the artistry of Mr. Theodore I. Schneider. Mr. Schneider undertook this exacting work as a hobby, but he became so distinguished a master of it that the American Museum is privileged to have several examples of his work among its exhibits

The Cru

Every sea catfish carries in
of the Easter Season, which
gious lore of many peop

By N. J. BERRILL
McGill University

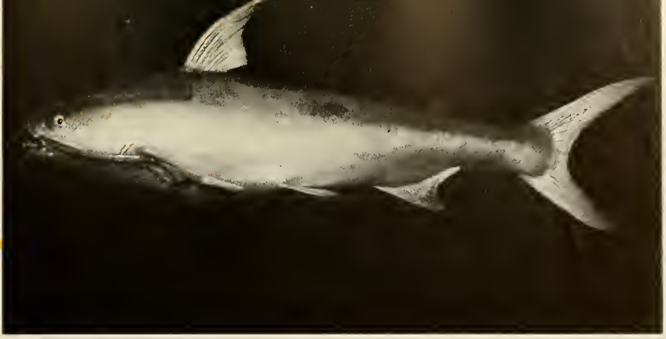
COLUMBUS was a deeply religious man. When he crossed the ocean for the third time, the first land he saw he named Trinidad after the Holy Trinity. Some days later his ship sailed past the mouth of the Orinoco into the Gulf of Paria. Fish of many kinds were caught and eaten, and the sea catfish was certainly among them. But the heads and bones must have been thrown away, for Columbus by this time was convinced he was getting close to the lost Eden, the Earthly Paradise, and he would not have overlooked the Sign of the Cross. Had he himself seen the skull of the Crucifix Fish, surely his mood would have prompted him to speak of it in his letter to their Royal Highnesses.

In any of the coastal towns of South America and through the West Indies you can find these skulls in any curio shop. People are said to hang them on the wall in place of a crucifix, and they have been venerated for centuries as charms against danger and sickness. The lower jaw is not included. If you hold the skull in your hand with the underneath side uppermost, the bones of the roof of the mouth form a crucifix. The cross is there, and so is the figure of Christ. You may even discern what looks like a crown or halo.

Once the symbol of the cross itself was recognized, almost every other bone in the skull was brought into the picture. The peculiar bones that look like the halo have also

ifix Fish

ead a remarkable reminder
res prominently in the reli-
northern South America

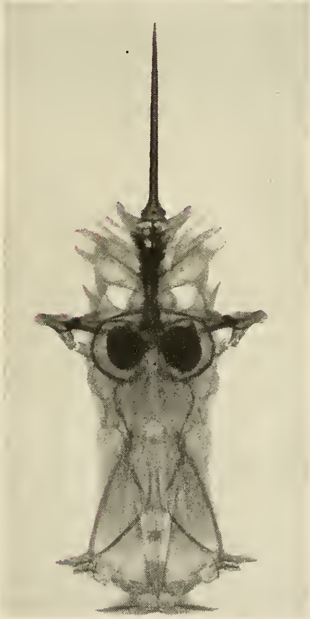


▲ NOTHING in the external appearance of this bewhiskered fish would suggest the hidden beauties of its internal architecture

been interpreted as the steps to the cross. If the skull is turned over, you see the breastplate and the spear of the Roman soldier; and if you shake the skull, you hear two objects inside rattle loudly — the dice with which the soldiers cast lots for the garments of our Lord. An account of the fish written in 1789 states that "when the bones of the head are separated, each represents some one of the instruments of the Passion of our Redeemer, forming spear, cross, nails, etc." Others have seen the upper side to be a hooded monk with outstretched arms.

Such is the symbolism. How, then, do these strangely shaped bones serve the fish? The robes of the monk are the skin bones of the head fused together to protect the underlying brain. The two largest spaces between the skirt of the robe and the feet of the monk are where the organs of smell lie tucked below the surface. The post of the cross is the solid axis underlying the brain and extending the rigid axis of the head to the snout itself.

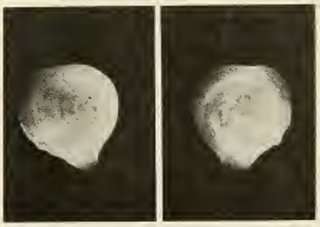
When the skull is shaken, the dice rattle. These are the ear stones, or otoliths, hidden away in their boxes just below the arms of the figure. Bone must be cut away to get them out. As ear stones they serve the fish as part of the mechanism for static balance. They are loose, but they grow as the fish grows, fast in summer, slow in winter, so that when they are cut through they show annual rings like tree rings, indicating the age of the fish.



X-ray by Dr. Sidney Rubenfeld

◄ WHEN THE SKULL IS SHAKEN, there is a loud rattling noise, caused by two ear stones, which have been interpreted as symbolizing the dice with which the soldiers cast lots for the garments of Christ. The ear stones can be seen as two dark spots in this remarkable X-ray photograph

▼ THOUGH THE EAR STONES are loose in their capsules, they grow as the fish grows, forming annual growth rings somewhat like those in a tree. These were taken from a fish 4 or 5 years old

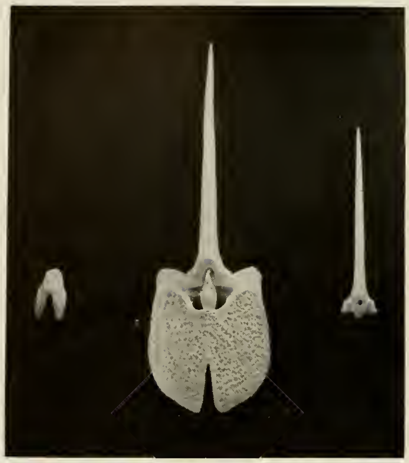


The halo consists of three pairs of bones, although one pair dominates. These are the Weberian ossicles, so-named after their discoverer, and they act as a chain of bones connecting the air bladder of the fish with the back of the ear cavities, in the same way that the hammer, anvil, and stirrup in our middle ear connect the eardrum with the sense organ itself, the inner ear.

To speak of the ear is a little confusing, for in our own case and that of all land vertebrates the ear is a double organ, part for balance and part for hearing. The fish lacks the hearing part as we know it. But catfish and their closer relatives have independently evolved something comparable to it. The ossicles have been made, long ago, from parts of vertebrae of the neck, and they connect the ear capsules with the air bladder, so that a sense of hearing of a kind has been added to the organ of balance. Recent experiments, in which loaches were made to respond to a dinner bell, flute, or other sound, suggest that fishes detect water-borne vibrations, whether they be called "sound" waves or not.

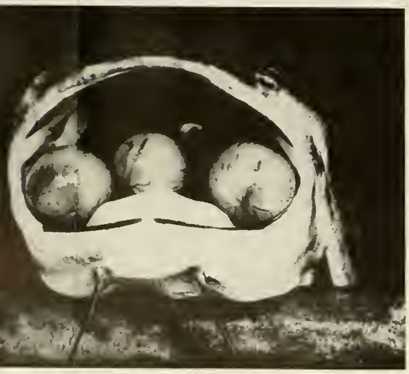
Most zoologists believe that the

➤ **Symbols** of the spear and breastplate of the Roman soldiers have been seen in the movable spine that supports the fish's dorsal fin and in the shield-shaped bone at its base. At left, you see a small sliding bone that works like a bayonet lock to keep the spine in an erect position. At right, in this illustration, the spine is removed from its base



➤ **The skull** with the spine raised

air bladder of a fish was originally one of a pair of lungs such as the lungfishes retain to this day. In most bony fishes the bladder is completely sealed off from the outside of the animal and functions as a hydrostatic organ. Some fishes, however, have stopped short of this, and in the catfishes especially, which include the Crucifix Fish, the bladder keeps its open connection with the throat. Now, while the air bladder probably has its hydrostatic function, the open tube enables the fish to grunt. This, in its own way, is a voice. But it is very difficult to discover how much this organ may be used to call other catfish, especially during the mating season, and how much it may be used to register changing pressure related to the depth of the fish in the water.



➤ **From spring until summer**, the father fish carries the eggs in his mouth, as shown here. His appetite disappears, and the young fish swim around in his mouth until they are about four inches long

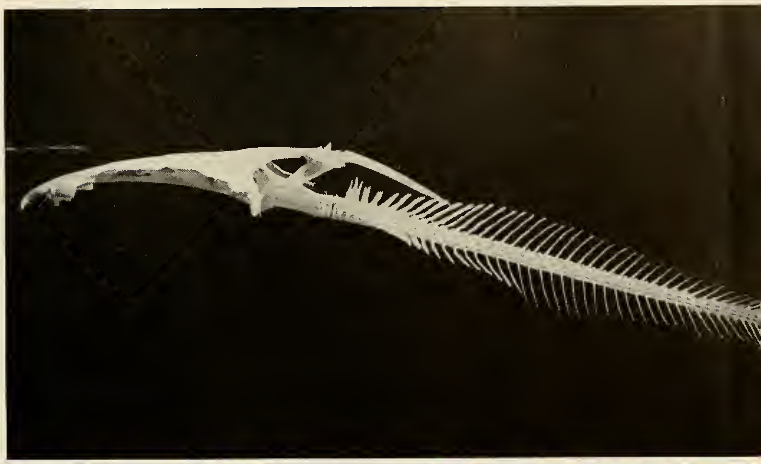
Turning again to the upper side of the crucifix skull, we have left the breastplate and the spear. The breastplate is another skin bone. It extends backward from the skull and serves partly to protect the animal. But it also provides attachment for part of the great muscle system that brings about the swimming movement of the body. It is more than that, however, and here we need to look at the fish from the side and more from the point of view of a sailor or fisherman.

The Sea Catfish has another name, more akin to the sea and ships and the wind than to the mystic symbolism of the Christian Church. It is the Gaff-topsail Catfish, and according to the Oxford Dictionary, a gaff is a "spar extending the top of a fore-and-aft sail not set on stays," a spar that can be raised and lowered.

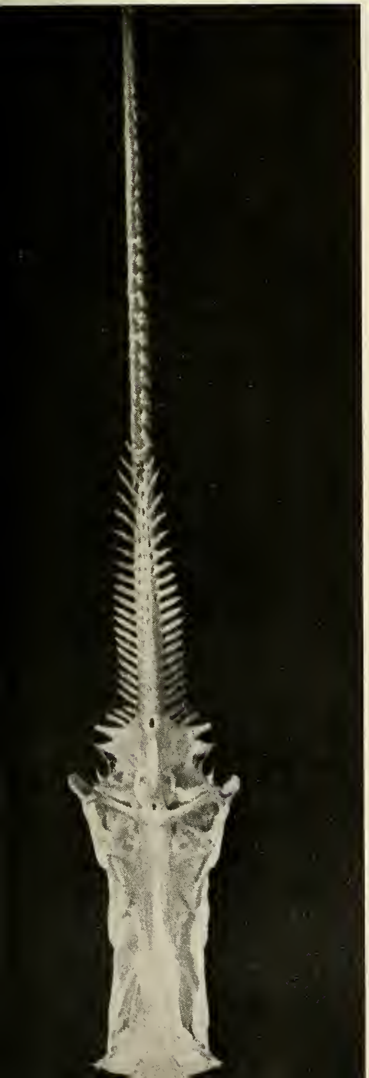
The spear is the gaff or spar and is actually a great dorsal spine that forms the fore-edge of the dorsal fin or topsail. The muscles that raise or lower the gaff pass down between the prongs of the breastplate and are attached to the sturdy growth of bone that rises from the back of the lower skull to the breastplate like a mast between decks. A short spine in front, at the base of the long spine, is "a nail of the cross" and acts as a stop to prevent the gaff from tipping too far forward.

Like the catfish of the rivers and lakes, sea catfish stay close to the bottom, grubbing along with barbels or whiskers probing and trailing, sensitized both by touch and taste to detect edible morsels. They stay close to the coast and frequent the estuaries and bays and mud flats near the mouths of rivers — regions where water is generally murky with suspended mud. Living as they do, sight is of no more value than other senses, and taste and touch loom as large in the brain as on the face.

Living as they do, these fish have special problems in reproduction. Muddy water is no place for fish fry to find the special small food organisms they need, and a mud bottom is a hopeless place on which to deposit eggs. So catfishes of all kinds, in the course of time, have done something about it. According to Dr. E. W. Gudger, the first steps can be seen in the common yellow catfish of the rivers. Their eggs are large, as fish eggs



▲ When lowered, the spine lies parallel to the fish's back just behind the neck



◄ The crucifix is located on the underside of the skull, with the arms of the cross near the neck

go, and they are laid in a sort of nest. But this alone is not enough. The parent keeps the water in movement, and as a final and potent gesture, the male periodically takes the developing eggs into his mouth and then blows them out with some force, keeping up the practice until the fry can swim freely. In this way they are kept clean and healthy, and at the same time the father realizes an instinctive paternity and refrains from swallowing his offspring.

So much for a river catfish. When it comes to a question of laying marble-sized eggs on marine mud flats, the problem becomes greater, for in addition to the smothering mud is the even greater menace of the voracious blue crabs. Therefore, sea catfish and some others have pushed paternal care to the limit. The Gaff-topsail of the Atlantic coast is typical. The eggs are golden yellow and average about three-quarters of an inch in diameter, and the female lays anything up to about seventy of them. These are large eggs from any point of view, and they can develop into small fish two inches or more in length before feeding becomes necessary. So if they can survive at all, they get an extremely good start in life. But the larger, more obvious, and heavier the eggs, the more protection they need, and in this case the male takes them into his mouth after they have been fertilized and for about ten weeks thereafter becomes a veritable perambulator. His mouth enlarges in anticipation of the nursery it has to be, and his appetite disappears entirely. Then, from spring into summer, the developing eggs are kept safe. They hatch when the embryo is about an inch and three-quarters long, but even then they stay within the bounds of safety. Dr. Gudger believes they feed on the microscopic crustaceans drawn into the father's mouth with the water he takes in for breathing. Apparently the young fish filter them out by their own finely-set gill rakers, for they do not leave their father to live their own lives until they have spent some weeks skating and swimming around in the mouth cavity and have grown to a length of about four inches! Then presumably they are fairly safe, even from their more or less cannibalistic mother, and once again the father can recover his desire for food and go about his own respectable masculine business.

The Bird that Baffled a

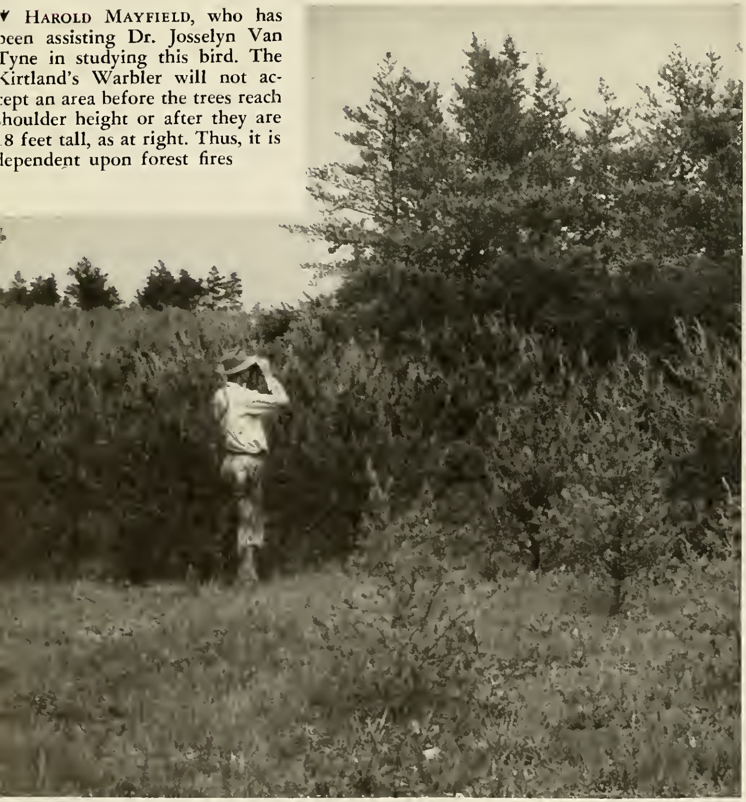
For half a century, bird students wondered where the Kirtland's Warbler disappeared in summer to lay its eggs

NORTH of Muskegon, we pulled off the highway and into a tourist court set among oaks near the eastern shore of Lake Michigan. We were less than half a day's run from the jack pine barrens of north-central Michigan, home of the Kirtland's Warbler, that rare and restricted bird we had driven a thousand miles to see.

That evening my wife and I thumbed once more through our bird guides, memorizing the habits and field marks of this songbird of the jack pines. Only in Oscoda, Crawford, and Iosco counties—with scattering records from adjoining counties; only in an area about 60 miles across and 100 miles long; only here, in all the world, is the Kirtland's Warbler known to nest. It breeds in the sandy jack pine barrens where new trees have sprung up in the wake of a fire. Not until these pines are five feet high do the warblers accept an area; as soon as the trees reach about eighteen feet, they abandon it. Thus each successive area is acceptable as a breeding ground for only about fifteen years. The Kirtland's Warbler depends, literally, upon forest fires for its nesting sites.

The riddles surrounding the life of this curiously restricted bird have stirred the interest of ornithologists ever since it first became known to science in 1852. On May 13, of the previous year, Charles Pease shot a small bird in a treetop near Cleveland, Ohio. The little migrant was unknown to him and also to his father-in-law, Dr. Jared Potter Kirtland, a Cleveland physician and naturalist of national standing. The bird was named *Sylvicola kirtlandii*, in honor of Kirtland, by Dr. Spencer Baird, Secretary of the Smithsonian Institution, in Washington, D.C. This has since been changed to *Dendroica kirtlandii*. The Cleveland physician, a friend of Agassiz and other celebrated naturalists of his time, also had his name bestowed upon a mollusk, a snake, a fossil plant, and a town. Kirtland, Ohio, a community east of Cleveland, derived its name from the same source as the Kirtland's Warbler.

About a decade after the first specimen was collected, a second one was taken—also at Cleveland. Then, in 1865, Dr. Baird made a surprising discovery. In checking over some specimens collected by S. Cabot, Jr., on a voyage to Yucatán, he came upon the skin of a Kirtland's Warbler. It had been shot at sea, near the island of Abaco, in the Bahamas, about 1840. This was a dozen years before the type specimen had been collected near Cleveland. For a quarter of a century the little bird had gone unnoticed among the many specimens result-



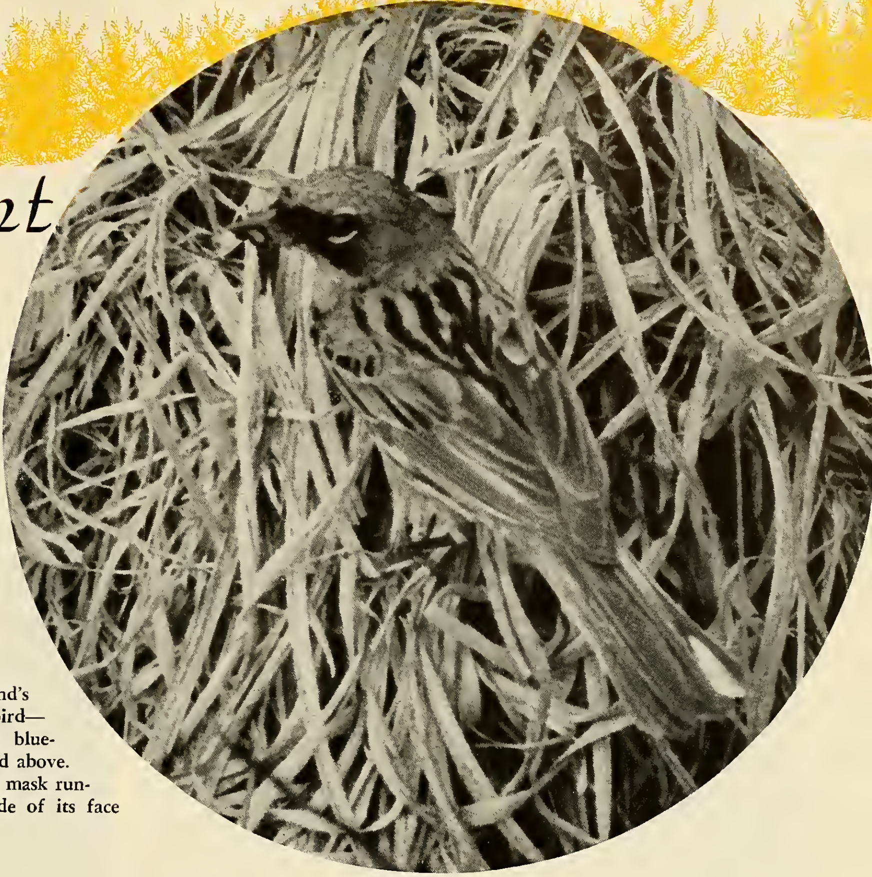
✦ HAROLD MAYFIELD, who has een assisting Dr. Josselyn Van yne in studying this bird. The irtland's Warbler will not acept an area before the trees reach houlder height or after they are 8 feet tall, as at right. Thus, it is ependent upon forest fires

ontinent

By

EDWIN WAY TEALE

All photographs by the author



▸ THE MALE Kirtland's Warbler is a striking bird—lemon-yellow beneath, blue-gray and heavily streaked above. It has a distinctive black mask running back along the side of its face

ing from the Cabot expedition, until Dr. Baird discovered it. His find gave a clue to the wintering ground of the warbler decades before its home and breeding area were known.

So matters stood for upwards of half a century. Single specimens were collected at rare intervals in South Carolina, Ohio, southern Michigan, Missouri, and—in winter—on several islands of the Bahamas. But, during every summer, the warbler disappeared. Ornithologists speculated on its breeding grounds. Some thought it nested in Alaska, others picked Labrador, still others maintained it bred on the tundras of northern Canada. As late as the fall of 1898, Dr. Frank M. Chapman was writing in *The Auk* that he believed the warbler nested in the region of Hudson Bay. "Owing to its rarity and the remoteness of its probable breeding range," he added, "its nest and eggs will doubtless long remain unknown."

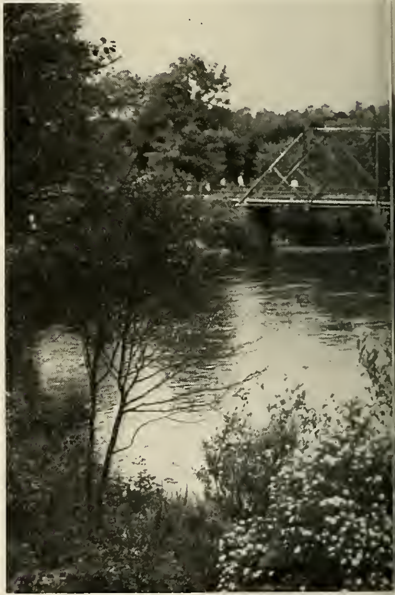
That prediction, however, was soon upset. By 1903, nest, eggs, and breeding grounds had all been located. Norman A. Wood, Curator of the ornithological collection at the University of Michigan Museum, in Ann Arbor, had come to the conclusion that the Kirtland's Warbler nested somewhere in the wild areas of northern Michigan. Early in June, 1903, his assistant, E. H. Frothingham, returned from a fishing trip on the Au Sable River with a story of a bird song he had never heard before and a specimen shot by his companion, T. G. Gale. Wood recognized the bird as the Kirtland's Warbler. A few days later, he was riding a Toledo, Ann Arbor, and Northern Railroad train to Roscommon, 35 miles by road from the spot where the song had been heard. This little lumber town, which he reached at four o'clock in the morning, was the nearest point on the railroad to his objective. There he rented a rowboat, and by seven that morning he was floating on the swift current down the south branch of the Au Sable River, starting on a 60-mile rowboat ride that would bring him to a new steel bridge spanning the river west of Mio in Oscoda County. This bridge was the landmark Frothingham had given him.

All day, Wood drifted downstream through wild and interesting country. He listed 40 species of birds before evening. After a night spent at a fishing camp, 35 miles downstream from Roscommon, he started again. On the alert for "sweepers"—cedars toppled into the river through undercutting of the banks — he made rapid progress down the main stream of the river. In open stretches he got out his tackle and caught trout and grayling as he drifted along. By six o'clock, he was hauling his boat ashore near the steel bridge. The date was the first of July.

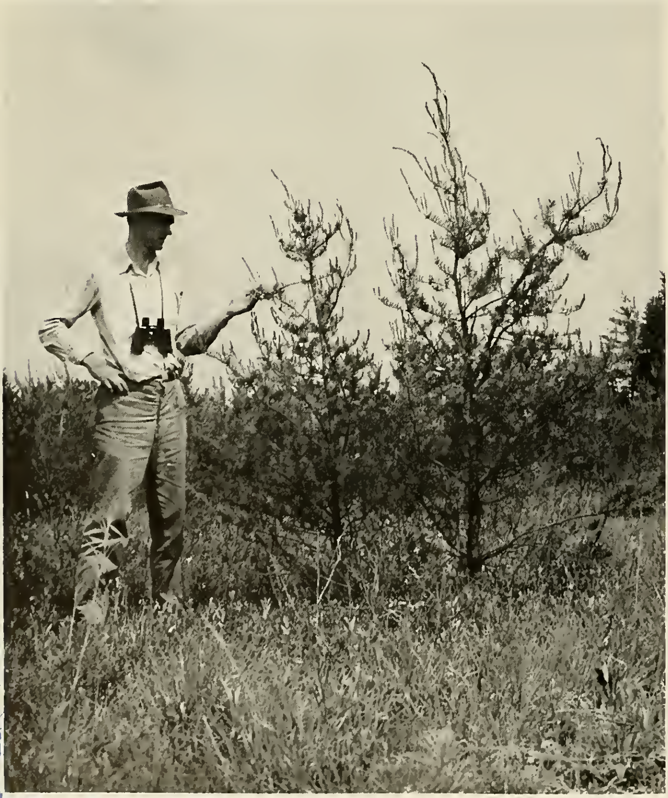
Seven days of searching followed. Half a dozen Kirtland's Warblers were heard singing, and one male was collected. But the nest eluded him. Then he came to a large tract of several hundred acres that had been burned over six years before and was now covered with young jack pines and a low growth of sweet fern, blueberries, and trailing arbutus. Here Wood came to the end of his quest. Later, he wrote of that moment: "It can be imagined with what delight I beheld the first nest of this rare bird ever seen and with what eagerness I dropped to my knees beside it to make a closer examination of its contents." The nest, about two inches deep and two inches across, held two young birds and a perfect egg. He discovered a second nest over the line in Crawford County. On July 16, a day so cold in Oscoda County that an overcoat was needed, Wood loaded his nests and the material he had collected into a farmer's rig and started on the laborious 35-mile drive over lumber roads to Roscommon. He had solved the long mystery of the summer home and the breeding ground of the Kirtland's Warbler.

The steel bridge that formed Wood's landmark still stands. We drove across it on our first day in Oscoda County. That day we cruised endlessly over the yellow-white sand roads that also form fire lanes. They run, a mile apart, in straight lines that cut the county into a great grid, each block of forest one mile square. Oscoda is still the most sparsely settled county in Michigan. It contains no railroad, no coal yard. Its few scattered communities all originated as lumber camps. Up until the time of World War II, it had no bus line, no doctor, no dentist. We saw deer trails forming straight lines across the sand roads as we drove along, often racked by stretches of washboard ruts and always followed by a moving cloud of dust. With straining ears, we listened for the unfamiliar song of the Kirtland's Warbler. We heard the trill of Pine Warblers, the lisp of Cedar Waxwings, the upscale "zee-zee-zee" of Prairie Warblers, and the curious, drawling, insect-like "buzz—buzz—buzz, buzz, buzz" of Clay-colored Sparrows. But nowhere did we catch anything resembling the song of the bird we were seeking.

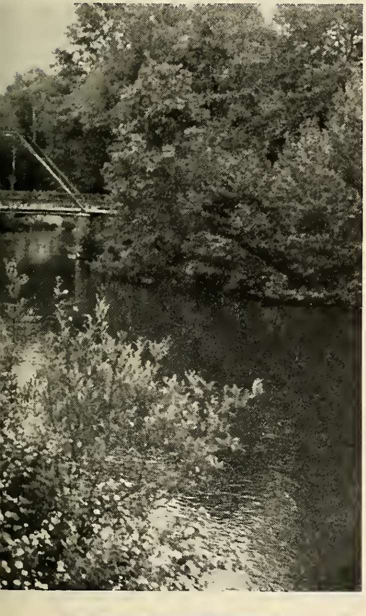
We assumed we were missing the



▲ WHEN, in 1903, E. H. Frothingham reported a strange bird in a wild section of Michigan, Norman A. Wood knew the warbler had been located. This bridge was the landmark that led him to its haunts



◄ ONLY FOR ABOUT fifteen years will the Kirtland's Warbler nest in a given section. During that time the trees of a burned-over tract grow from the five-foot minimum to the eighteen-foot maximum song. But, later, Roger Tory Peterson told me he had had a similar experience. He drove all day without hearing the bird; then, after he had heard it and was familiar with the song, he drove back over the same roads. He had not missed the song; the birds just were not there. They nest in scattered colonies, often miles apart. By evening, on that day of frustration, we were pouncing on fragments of familiar bird songs, slamming on the brakes even at unusual squeakings of the car. Completely discouraged, we turned into Hinchman Acres Camp, on the edge of Mio. And there Lady Luck appeared in the form of a small girl with a cowbird fledgling riding on her forefinger.



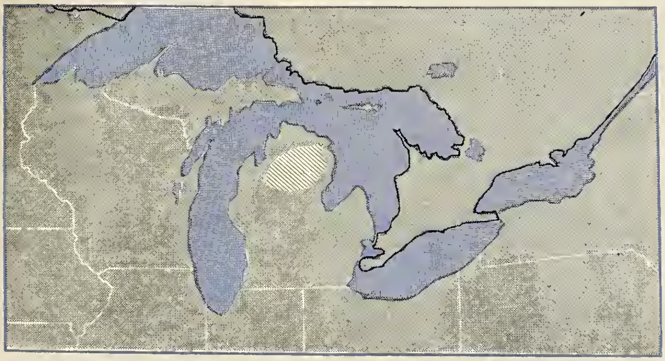
She came into the office as I was signing for a cabin. The manager explained:

"A lot of people here are interested in birds. We've got two bird doctors in camp, right now. They come up every year in June."

The "bird doctors" proved to be Dr. Josselyn Van Tyne, of the University of Michigan, and Harold Mayfield, a friend of mine from Toledo, Ohio. Dr. Van Tyne, outstanding student of the Kirtland's Warbler, has spent years studying the bird intensively. During ten successive seasons, he has spent at least twenty days in June—from five in the morning until six at night—observing the nesting warblers from a blind. For seven of those ten years, Mayfield has assisted him in the work.

That night, the four of us ate at Kookie's Kitchen, in Mio. Mayfield's work was over for the season, and he was free to show us a warbler's nest in the morning. Van Tyne still had a couple of days' work left, watching birds he had marked with colored bands. Before 4:30 the next morning, while a wood pewee sang its low, soft "twilight song" outside the cabin, we breakfasted with the "bird doctors" on doughnuts and coffee, grapefruit slices and bread, canned pears and orange juice. Thus fortified with vitamins, we started the day.

A new nesting area had been discovered not long before by Verne Dockham, Conservation Officer for the region. It lay among small jack pines, a dozen miles east of Grayling. Three or four pairs of warblers occupied it. Each spring, it is the habit of the returning males to stake out their territories, ranging from a hundred yards to a quarter of a mile across. Immediate chase is given to any small bird that invades the area. The alertness of the males is advertised by their endlessly repeated, far-carrying songs. It is the ear that first detects the presence of a Kirtland's Warbler nesting site.



▲ Nowhere outside the small shaded area shown on this map does the Kirtland's Warbler nest. It winters in the Bahamas

From mid-May to the last of June —the normal nesting season of the warblers—the song of the male is repeated with almost monotonous regularity. The first thing that surprised us about this song was its shortness. It lasts only about as long as it takes to say "Chattanooga choo-choo"—two seconds or less. The second thing was its loudness. Starting low, it progresses with an ascending "che-che-che," almost like a stammer, suddenly bursting out in a loud, ringing "wee-wee." Once, during the morning, I drove down the road to a slight rise a fifth of a mile away. In spite of the fact that the breeze was blowing in the wrong direction, I could hear perfectly a male singing in the top of a fifteen-foot jack pine.

In fact, when we were close to a singing warbler, the ringing final "wee-wee" was often so loud that it hurt our ears. The song of the Kirtland's Warbler has been described as resembling that of the House Wren and the Northern Water Thrush. It has a bubbling quality. The sound grows louder and faster as it progresses until the final notes come out in a sudden rush. The singing male has the appearance of being in the midst of a kind of spasm. It vibrates, jerks, bobs, seems to jump up and down with the violence of its effort. Its bill is lifted high, its lower mandible moving rapidly as though it were gobbling food. The song of one male seems to stimulate a reply from a neighboring warbler. The males sing when high in trees, low on branches, and even in flight. Several times we saw a male arrive at the nest with its bill crammed with small caterpillars. In spite of this impediment to song, it would pause on a branch near the nest, lift its head, and sing as loudly as ever.

The appearance of the Kirtland's Warbler is as arresting as its song. Conspicuous black streaks mark its bluish-gray back. Its breast is lemon-yellow with bold streakings along the sides and on the flanks. It is a large warbler, measuring five and three-fourths inches from bill to tail. The male has a distinctive black mask running back along the sides of the face. The female, lacking this mask, is clad in duller, grayer plumage. Both birds have the habit of jerking or wagging their tails. Even in silhouette and when the bird is silent, it can be distinguished from the Chipping Sparrow or other small birds by the characteristic jerking of its tail. The only other common warbler in the area that jerks its tail is the Prairie, easily distinguished from the Kirtland's by its reddish-brownish back.

Almost all day long, we sat only fifteen feet or so from the warbler's nest. Both birds were remarkably fearless. After only a short period of uneasiness, they came and went regularly. I set up my camera on a tripod in the open, no more than eight feet from the nest. In less than five minutes, the female was perching on the bellows. Once, when I was standing motionless beside the camera, the male actually dashed between the legs of the tripod in a rush to drive off a trespassing Chipping Sparrow. Individuals vary in shyness, but the Kirtland's Warbler is noted for its lack of fear. The second ornithologist to report a visit to the nesting area in Michigan, Edward Arnold, of Battle Creek, reported in *The Auk,* in 1904, that he found the female warblers so unafraid that they could be caught in the hands on the nest. One male, singing at the top of a jack pine, let me take a position directly under the tree, merely cocking his head to one side to look down at me. Even when I shook the tree, he flew hardly six feet away to the top of an adjoining pine. Unlike most warblers, shy and elusive, appearing and disappearing, the Kirtland's is a dominant personality—one of the outstanding birds of the pine barrens.

The nest, where we spent most of our time that day, was on the ground hidden among blueberries and sweet ferns and dry, wiry grass. The adult birds reached the nest through a kind of tunnel or bower of overarching grass. The nest, itself, was a little cup lined with fine grass, bark, and deer hair. It contained four fledglings in pinfeathers. They had hatched from white eggs speckled with brown. The incubation period for such eggs is about fourteen days. For ten days after hatching, the birds remain in the nest. During the early part of the nesting period, cold snaps are not uncommon. There is a record of frost for every month in the year in Oscoda County and often Van Tyne and Mayfield find their shoes white with rime when walking across the frost-covered pine barrens in early June. Under such conditions, the warblers seem to cease operations. If the nest is half-done, work is stopped; if it is completed, the female delays laying the eggs until warmer weather arrives.

The site of the nest is almost always the same: a little opening surrounded by young pines. Their low branches provide the required steps or perches close to the nest. Almost always the birds we watched

◀ **Fire has killed** this jack pine. If young growth succeeds it, the spot will be acceptable to the Kirtland's Warbler

➤ THE FEMALE is clad in less brilliant plumage and lacks the mask. These birds are remarkably fearless

AN ADULT ANT LION, an insect that forms part the food of the nestling Kirtland's Warbler

hopped from branch to branch in approaching the nest. When the trees grow too large and the branches interlock and shelter the little glades that had been open when the trees were young, the warblers move to new nesting sites. Comparatively few enemies prey on the warblers in the pine barrens. Sharp-shinned hawks sometimes skim down to carry them off, and in a few instances, cowbirds remove the warbler eggs and substitute their own.

In feeding, the warblers appear to comb the lower branches of the pines, usually within three feet of the ground. Small caterpillars, varied with an occasional gauzy-winged adult ant lion, was staple fare on the day we watched the endless procession of meals being brought to the nest. Not infrequently, one of the birds would gobble down a caterpillar hastily, usually the first one encountered after feeding the fledglings. Each time it followed the same procedure. It cocked its head, snapped up the worm, gulped it down, and then wiped both sides of its bill on a twig rapidly as though whetting a knife—jerking and wagging its tail all the while. The tail wagging seems to increase at times when the warbler is excited.

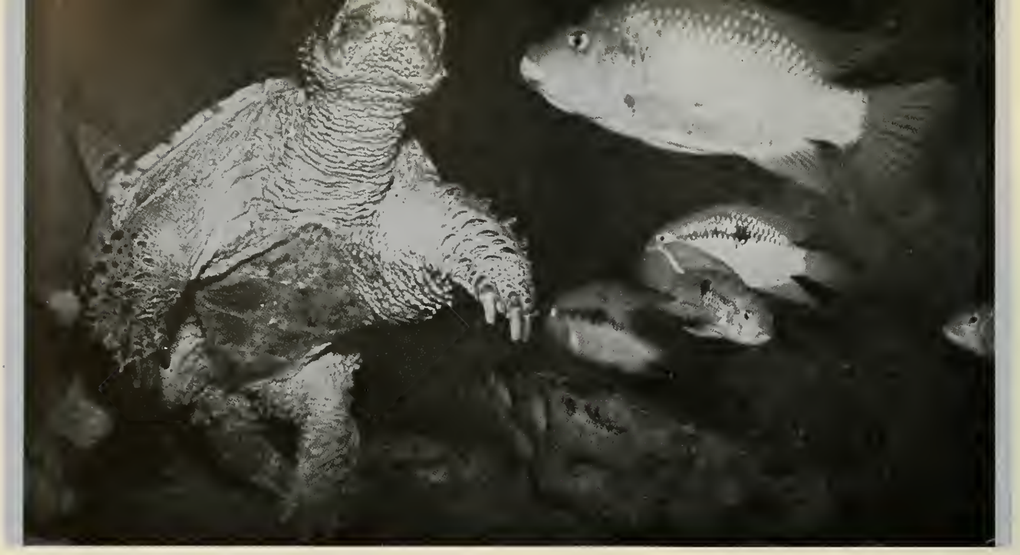
On one occasion, we saw a female flutter like a flycatcher to pick an adult ant lion from the air. Three or four times the male returned with the wings of one of these insects projecting like long moustaches from either side of its bill. Ants are everywhere in Oscoda County's sandy soil. So are the ant lions which, in their immature form, excavate conical pits in which to trap their ant victims.

One curious thing about the feeding habits of the Kirtland's Warbler is the fact that neither Van Tyne nor Mayfield has ever seen one of these birds drink water. Perhaps they obtain moisture from the heavy dews that are characteristic of the region. Or it may be that the larvae they consume provide sufficient fluid for their needs.

On each trip to and from the nest, the birds we observed most closely used the little tunnel of overarching grass. At the end of every visit, as the warbler emerged from this bower of grass, it gave a little fluttering bound, six or eight inches high, as it flew away. This upward bound and flutter was characteristic of the pair we watched.

The Kirtland's Warbler spends only about four months out of the year among the jack pines of its Michigan breeding grounds. The birds return from the south sometime between the tenth and the fifteenth of May. Males and females arrive together. By September, the warblers, old and new, are moving southward on their migration to their wintering grounds on the islands of the Bahamas. Snow comes early in the Michigan pine barrens. The winter is long. During these months, when deer and foxes and snowshoe rabbits are leaving their trails in the drifts, the small band of jack-pine warblers, having traveled south and out over the sea, are living in a land of plentiful food and sunshine.

The next day when, like birds migrating southward out of season, we headed away from the jack pine barrens and their rare warbler inhabitants, we remembered W. H. Hudson's delight on seeing the Dartford Warbler of England, the almost-vanished "furze fairy." Ever afterwards, when anyone mentioned having seen a rare species, Hudson used to say: "But *I* have seen the Dartford Warbler!" We felt the same about this colorful little songbird of the jack pines. *We* had seen the Kirtland's Warbler!



▲ This ponderous inhabitant of our muddy ponds and rivers can bite the end off a broomstick, but he cannot dart quickly about in quest of the fish upon which he depends for food. He uses a built-in angling worm in his mouth to lure his prey within grasp

SNAPPERS–Underwater Fishermen

Unlike the small boy who has to dig for worms the day before he goes fishing, the giant alligator snapping turtle is equipped with his own wriggling bait

By Woody Williams

Photos by the author, courtesy Steinhart Aquarium, California Academy of Sciences, San Francisco

A PUBLIC AQUARIUM is a different place when the last curious visitor has left. The halls are quiet and the light in the tanks dim. Many of the creatures react to the softened light by settling to the bottom to rest. Their show for the day is over.

There are certain creatures, however, that slyly become busy after dark. Take for example the giant alligator snapping turtle, *Macrochelys temminckii,* at the Steinhart Aquarium in San Francisco. He picks a corner of the tank, or a passageway in a rock, where other inhabitants of the tank are prone to rest, and then he begins to fish.

He opens his ugly jaws wide and remains motionless — except for a curious, wormlike structure in his lower jaw. It is close to his tongue but lighter in color. The two free ends of this organ are rapidly rotated, imitating the squirming movements of a worm or grub. Generally, the turtle sets this apparatus in motion when he is near a fish cornered in the tank bottom, where escape is restricted. His prey seems hypnotized; it remains motionless, as if frozen by fear. The turtle then edges a bit closer and, when within striking distance, lunges at the fish with jaws open. The snap when he claps them shut can be heard through the thick plate glass of the tank. Despite the confined quarters, the victim often escapes, but the scarred sides and torn fins of a number of the fish—large South American cichlids—indicate many narrow escapes. I have actually observed the turtle catch a fish six inches long, hold it between his jaws for a moment, and then gulp it down whole.

Raymond L. Ditmars, the well-known American herpetologist, was the first to report this curious device in the snapper's mouth. His observations, along with other scattered reports, seem to indicate that fish are lured near or into the snapper's mouth in an attempt to catch the "bait," which inside the gaping jaws looks like a worm in a small cave. There is no doubt that in nature the lure is effectively utilized for food capture, for the turtle is normally moss-covered and when motionless looks like nothing more than a submerged rock. In Steinhart's tank, however, fish were never observed actually to swim or dart toward the lure. Of course, constant association with the turtle may have modified their normal reactions. Having been attacked so many times, the fish have probably come to fear the snapper's gaping jaws and bulky body, which are not so well concealed as they would be in a muddy pond in the Mississippi Valley. Thus the turtle can hope to satisfy his appetite only by backing a resting fish into a corner.

In the wild, the snapper's favorite haunts seem to be muddy areas varying in size from ponds to large rivers and bayous. Its range extends from northern Florida northward to Quincy, Illinois; along the Ohio to the Lower Wabash; and westward to San Antonio, Texas. The fossilized remains of this creature have been found in Pleistocene deposits on the Brazos River a short distance above Navasota, Texas.

Throughout its range the snapper's only nonparasitic enemy is man, who sometimes hunts it for food or kills it in the belief that it depletes the supply of waterfowl and game fishes. Its eggs are also occasionally eaten.

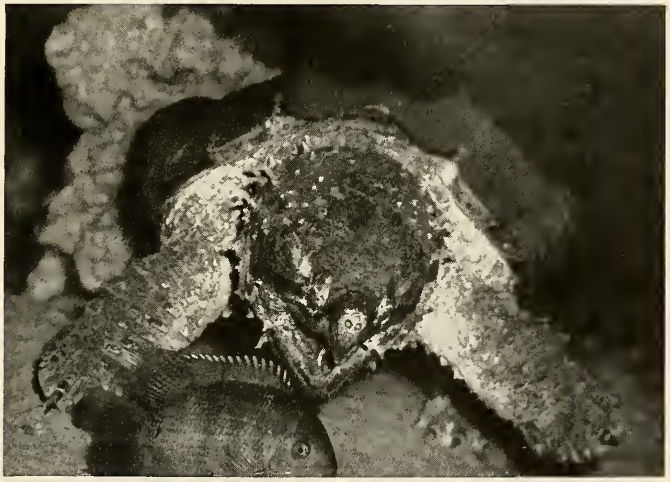
The snapper is the largest freshwater turtle in the United States, attaining a length of over 2 feet and a weight of over 200 pounds. It is famous for its tremendous strength. One specimen was reported by Ditmars to have easily severed three inches off the end of a broomstick, and he had seen snappers cut up fish so neatly that the pieces looked as clean as if sliced by a die. Clifford H. Pope, in his *Turtles of the United States and Canada,* mentions a snapper that carried, without concern, a 165-pound man on its back in Metropolis, Illinois.

Ditmars says that these turtles are shy when in captivity without cover, but the literature also indicates that once a snapper is aroused to anger, it will strike like a snake. Caution should therefore be observed in handling these creatures.

The snapper probably lives for many years. One specimen survived for 42 years in the Brighton Aquarium, and one for 47 years in the Philadelphia Zoological Garden. As the latter specimen was well grown when received, it is believed to have reached well over 50 years of age. The large male shown in the photographs, which is now on exhibit at the Steinhart Aquarium in San Francisco, may readily have reached this age.

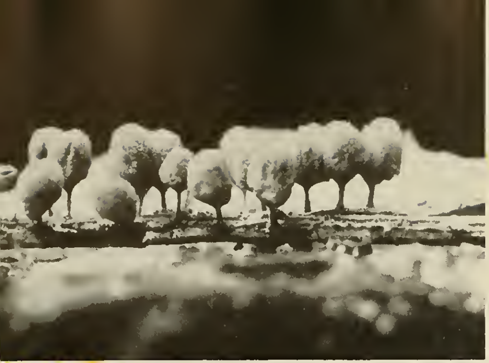
When you observe these ponderous creatures rising to the surface for a gulp of air, or ambushing a fish with their curious lure, it is easy to believe not only that they are well equipped to attain a ripe old age but that they may have snapped their way through quite a chunk of history.

▲ RISING to the surface to breathe: an air-breathing animal that has invaded the underwater world to carry on one of the strangest fishing methods found in nature



▲ THE WHITISH, WORMLIKE ORGAN on the floor of the mouth has two free ends, which rotate rapidly like a squirming worm or grub. The fish remains motionless, as if hypnotized

◀ EDGING CLOSER, the turtle lunges at the fish with jaws wide open. The snap of the powerful jaws can be heard through the thick glass of the tank



▲ **Like a forest** of miniature trees, *Arcyria denudata* spreads its brick-colored "foliage" 1/16 of an inch above the surface on which it grows

Little Mike

Enter the mysterious realm where plant and animal are almost one, and you will witness one of the most astonishing transformations in Nature

By Hugh Spencer

Photographs by the author

IN the middle world that lies between the plant and animal kingdoms there flourish several half-plant, half-animal organisms that bear characteristics of both groups. Most interesting among these are certain fungus-like creatures that are known by the not very prepossessing name of slime molds. In botanical terminology they are called Myxomycetes (pronounced Mix-o-my-SEET-eez).

The motile phase of this organism is called a plasmodium. It has the consistency of thin jelly and moves about freely, creeping through moist spaces in rotting wood or among dead and decaying leaves. It has no fixed form or shape but varies like a thundercloud, putting out feelers that billow out and expand as the rear end is withdrawn and absorbed. Unlike most living things, it has no cellular structure or specialized tissues of any kind. It glides along absorbing food (decaying vegetable matter, living bacteria, and fungal hyphae) from its environment.

Collecting and studying Myxomycetes can be a most entrancing hobby, and, although the number of persons who pursue this avocation is not great, those who have tried it have been amply entertained by the unique character and behavior of their pets.

In the life of a slime mold there are two conspicuous phases—plasmodium and sporangia. After weeks or months, sometimes years, of unfettered existence in moist, dark retreats, the plasmodium seeks a higher, drier location in which to transform from creeping jelly to stationary sporangia. The multinucleate protoplasm changes into one or more complex structures having many characteristics of fungi.

The nature photographer, in pursuit of new material for his negative files, may spend many hours in the field and return empty-handed and weary at the end of the day. Then, in his own dooryard, or while sitting quietly in his studio in the evening, something he has long sought in vain turns up right at hand. Such was the case with Little Mike.

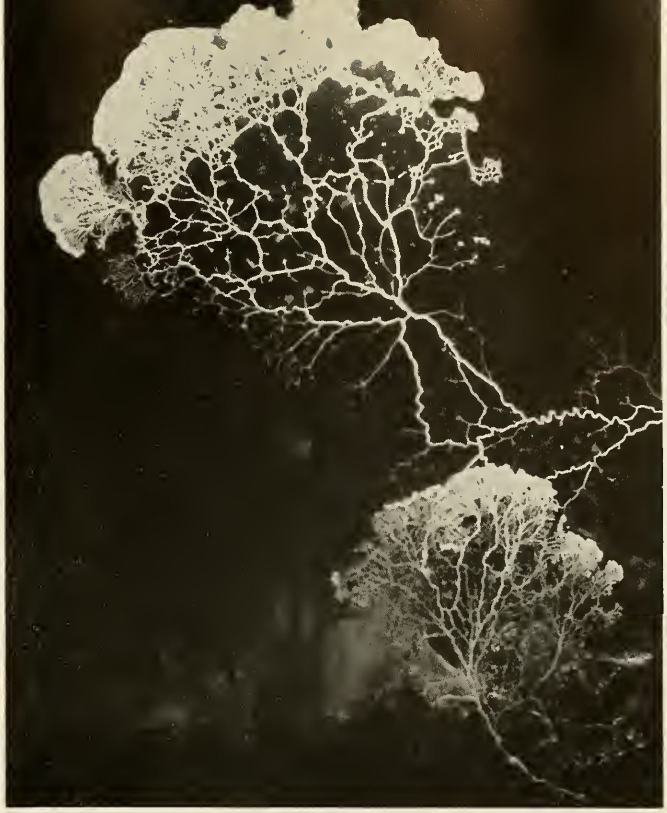
A tobacco jar on my worktable, which had previously served as a terrarium for some small frogs, was the scene of my first encounter with the motile Myxomycete. Sphagnum moss and some dead leaves filled the bottom of the jar. One evening out of this material, slowly pulsing up the side of the glass, arose the fanlike network of Little Mike's advancing plasmodium. Fascinated, I watched while the pattern moved and changed like cumulus clouds rolling up the sky on a summer afternoon. Slime mold! What an utterly shameful and inappropriate name for one of Nature's most amazing and beautiful forms of life.

Older zoological literature places the Myxomycetes among the Protozoa and thus in the *animal* kingdom. Some have called them Mycetozoa, or "fungus animals." But leading modern authorities regard them as fungi, which are part of the *plant* world. Thus our mystery organism, along with several groups of flagellates, enjoy the curious distinction of having been placed in both of the primary divisions of life.

Fusing, or confusing, Myxo with Myceto, we came up with "Mike," and consequently Little Mike is the nickname by which the specimen in the tobacco jar will henceforth be designated.

Little Mike was a translucent, milky-white tracery, with the leading portion forming a fan of radiating veins. These veins, flattened against the glass to the size of a quarter-dollar, were trailed by a mesh of lesser veins. Below this a second mass of smaller size pushed up out of the muck. The rate of progression was about a quarter of an inch an hour. On several successive evenings I watched Little Mike advance and retreat, expand and contract, exploring the surface of the jar and, apparently, always striving for some higher, better life than that in the wet soil.

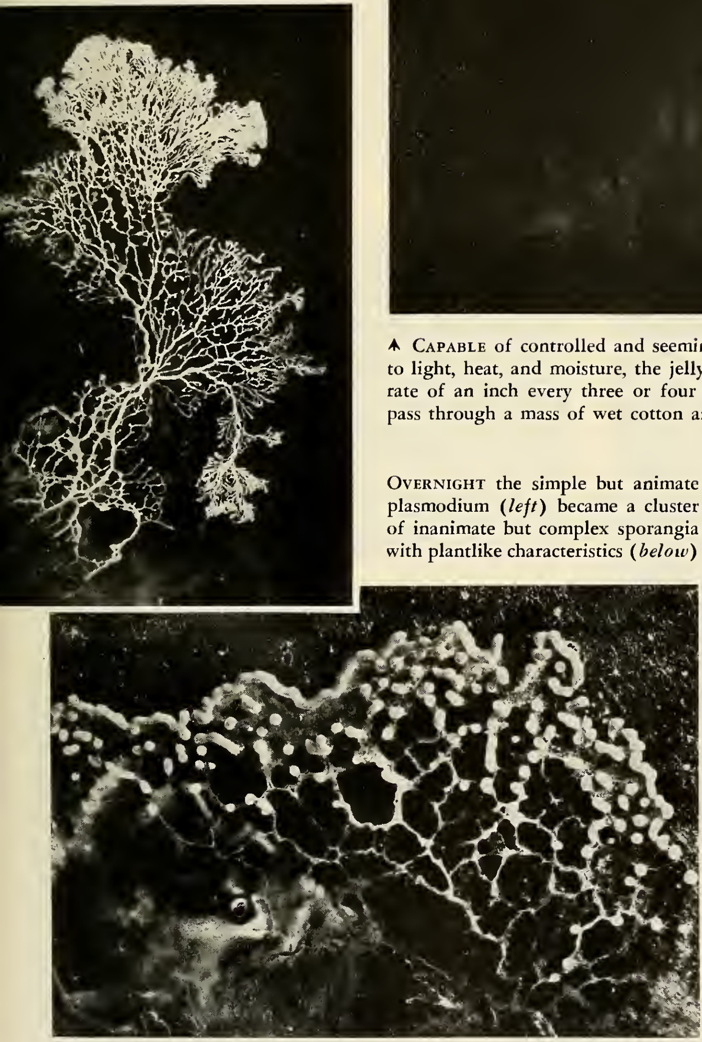
Animated protoplasm without nerves, without brain, without muscles, heart, or respiratory organs, yet capable of controlled and seemingly purposeful movement, of response to light, heat, and moisture —surely such a thing is worth anyone's attention. Think of it: a thing able to select digestable material; fluid enough so that a specimen has been known to pass through a mass of wet cotton wool and re-form on the other side, yet firm enough to



▲ **Capable** of controlled and seemingly purposeful motion and of response to light, heat, and moisture, the jelly-like plasmodium surges forward at the rate of an inch every three or four hours. A specimen has been known to pass through a mass of wet cotton and re-form on the other side

retain character and unity under normal conditions; and, further, an organism able to change its structure into the diversified tissues of reproductive sporangia.

Fructification is the ultimate goal of all slime molds, as it is of higher plants and animals. So far, our creature has behaved like an animal: it moved like an animal, its feeding habits were animal-like, and its behavior was like that of a giant amoeba. I did not witness the transition of Little Mike from motile plasmodium to stationary sporangia, as that event took place during the hours of night or early morning. Overnight the creeping fungus had reached the top of the jar and had broken up into a multitude of minute, spherical sporangia, smaller than pinheads and tangled in a stain of dried and hardened tissue. All that remained of Little Mike was now a cluster of structures bearing no resemblance to the original organism. Without seeing the metamorphosis, or at least having previous knowledge of the behavior, one would have difficulty recognizing these motionless bodies as the alter ego of the erstwhile roving plasmodium. The process by which this rudimentary film of protoplasm becomes a complex structure of differentiated tissues is one of the most astonishing phenomena of nature.



Overnight the simple but animate plasmodium (*left*) became a cluster of inanimate but complex sporangia with plantlike characteristics (*below*)

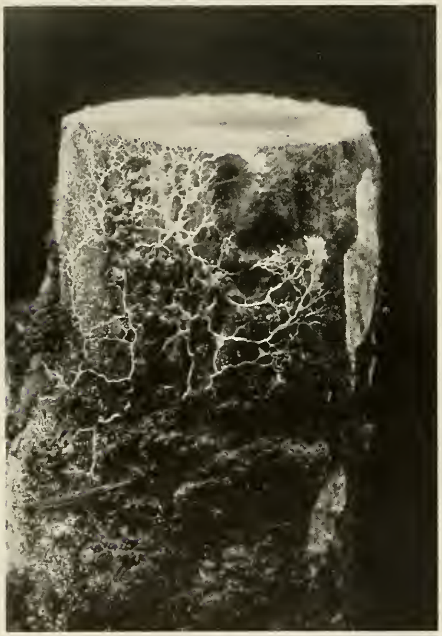
The sporangia of different species

▲ CHANGE IN TWELVE HOURS. On a July evening, this slime mold was found spreading over the ground near a compost heap in the garden. The following morning these biscuit-shaped masses had appeared, flattened against the ground. The largest were about four inches across

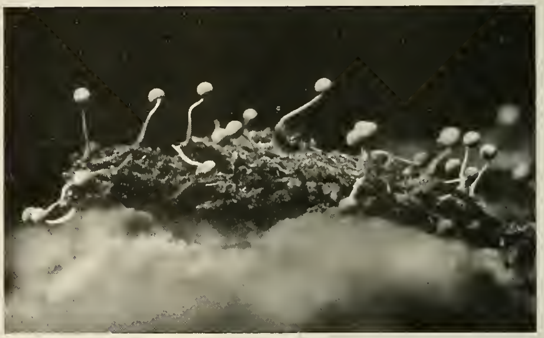
vary greatly in size, shape, and color. Little Mike was a *Physarum* with minute globular sporangia. *Stemonitis* produces clusters of slender plumes less than a quarter of an inch in length. Under a magnifying glass a group of *Arcyria denudata* looks like a forest of miniature trees with brick-red foliage. The largest species is *Fuligo*, which produces sporangia as large as a man's hand and about an inch thick. Although these sporangia differ greatly in appearance, their function is the same in every instance. All of them produce minute spores, which are easily scattered by the wind and will germinate readily wherever they find suitable moist conditions.

The ensuing stages between spore and plasmodium can be observed only with the aid of a microscope. The naked, amoeboid protoplast that escapes from the spore

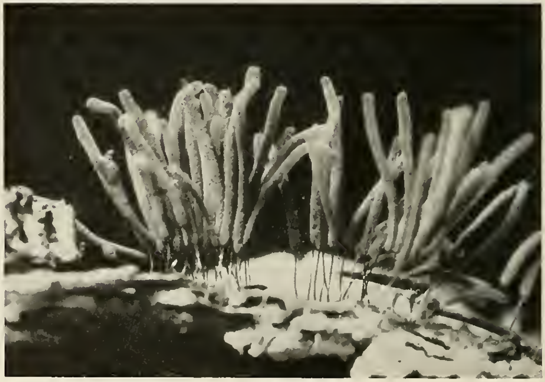
Continued on page 190



▲ A YELLOW PLASMODIUM on an old stump. The extended rays and branches would aggregate many feet in length



▲ THE TINY GLOBULAR SPORANGIA of *Physarum* on their slender stalks



➤ DAINTY PLUMES of *Stemonitis*, commonly found near oak trees. These Lilliputian "cat-tails" stand about 3/16 of an inch in height

Photo by U. S. Forest Service

▲ Evergreen forests and myriads of lakes characterize the Quetico-Superior wilderness

CONSERVATION *Victories*

By Richard H. Pough

Chairman, Department of Conservation American Museum of Natural History

In a field in which defeats have all too often been the order of the day in recent years, it is heartening to have two great conservation victories to report.

Under the terms of a recently issued history-making executive order, an air-space reservation has been established over the million-acre Quetico-Superior wilderness area of northern Minnesota. On January 1, 1952, all flights into the area or over it at less than 2000 feet must cease. This should put an end to the resorts that were beginning to grow up deep inside the roadless area and were so out of keeping with its whole character. It should also expedite the task of buying out the few privately owned tracts that still lie scattered through the publicly held national forest land.

This air closure removes one more obstacle to the final creation of a great international peace memorial forest on both sides of the United States-Canadian border. It will be a forest open to all who seek solitude and are willing to find it via the canoe or on foot. The final establishment of such an area will make certain the preservation for all time of at least one area in the United States remote and wild enough for the survival of a small nucleus of timber wolves, which disappear everywhere as civilization moves in. Here there will be no reason to

Ewing Galloway photo

◄ Snake River and the Teton Mountain Range challenge nature's law that the race belongs to the swift and that the plant eater lives but to feed the meat eater.

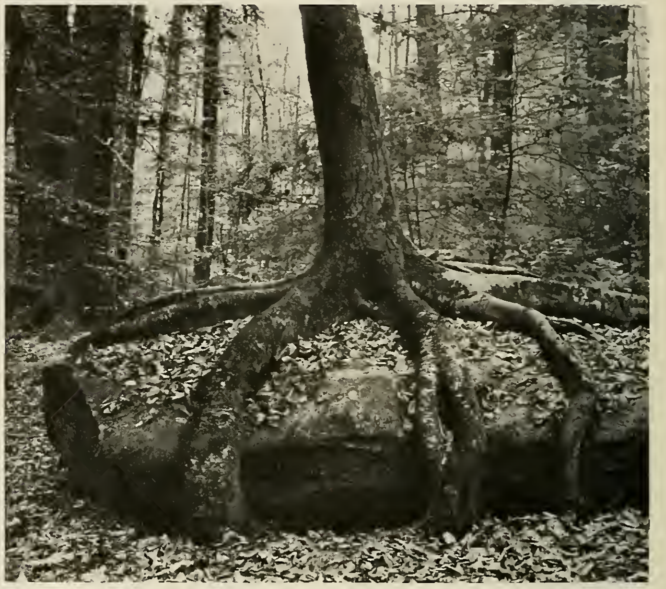
With the deeding of some 300,000 acres of land in Jackson Hole to the National Park Service by the Rockefeller interests, the long-drawn-out controversy over the Jackson Hole National Monument comes to a virtual close, and the preservation of the primitive character of this glorious valley is assured. A few problems remain to be solved, but they can now be worked out on a calm basis of fact instead of in the heat of political battle. The most important problem concerns the elk population that summers in Yellowstone Park and the adjacent national parks. Blocked now for many years from access to their ancestral wintering grounds in the Red Desert, these elk must be prevented from increasing to levels that can only result in wholesale starvation and devastating damage to the limited wintering range still available. In the absence of predators, this means that there must be sufficient sport hunting or annual butchering by park rangers to hold the population at the level where it can be supported in vigorous health and where it will not overbrowse and destroy its food supply.

For the first victory, every American conservationist who did not leave it to the other fellow but made his own voice felt can take credit. This is in part true also in the second case; but let us not forget that there would have been little to battle for if a public-spirited American family — the Rockefellers — had not been willing to provide nearly one and a half million dollars to purchase the critically important Snake River bottomlands that years ago had been allowed to pass into private hands.

Unfortunately, many another conservation project having equally great public support—such as the attempt to save as a national park or wildlife refuge the last small section of undeveloped beach on the coast of New Jersey—languishes for lack of more Americans as public-spirited as the Rockefellers.

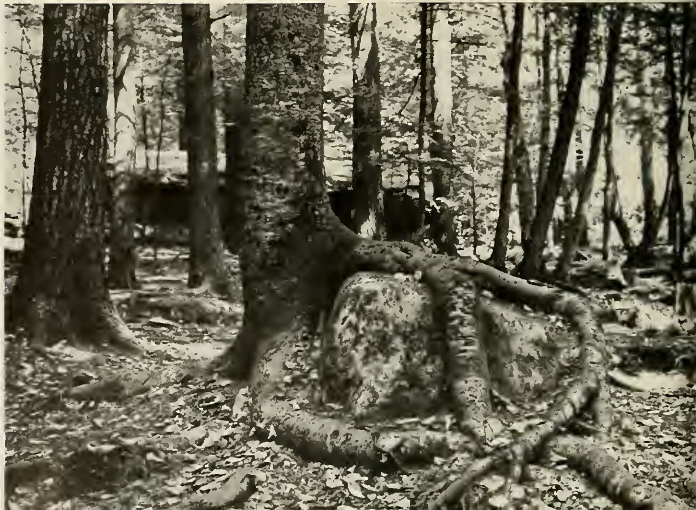
Woodland

How startling—and sometimes baffling—are the ways in which



"My woodland throne,
I must confess,
Was won by means
You may not guess."

A branchlike root
Above the ground—
Did the rock rise up
Or the tree slip down?



Vonders

ng tree grows with all odds against it!

By William M. Harlow
New York State College of Forestry

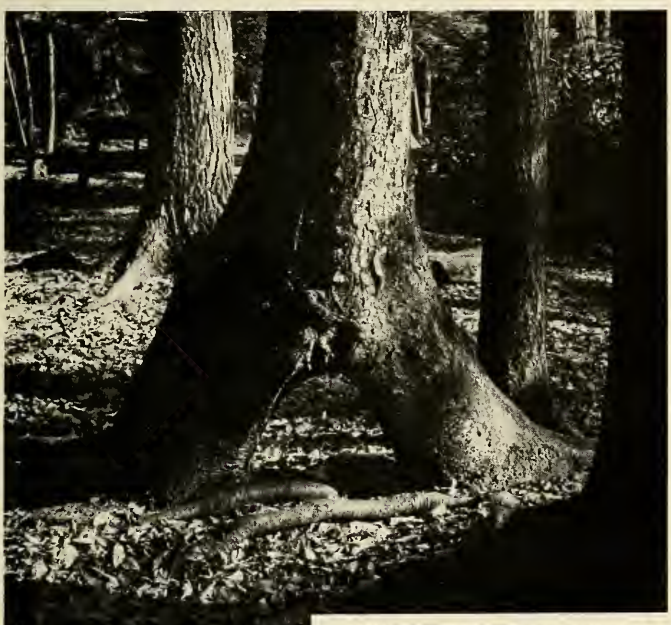
Photographs by
Helen Faye

ONE of the most interesting things to observe in the woods is the manner in which a young seedling tree makes the best of a seemingly hopeless or at least difficult situation and manages somehow to live and grow and even to prosper. In these days of Existentialism and other hopeless philosophies, it does one good to walk along a woodland trail and to see trees like the ones pictured on this page. They were all photographed in Cook Forest Park, Pennsylvania.

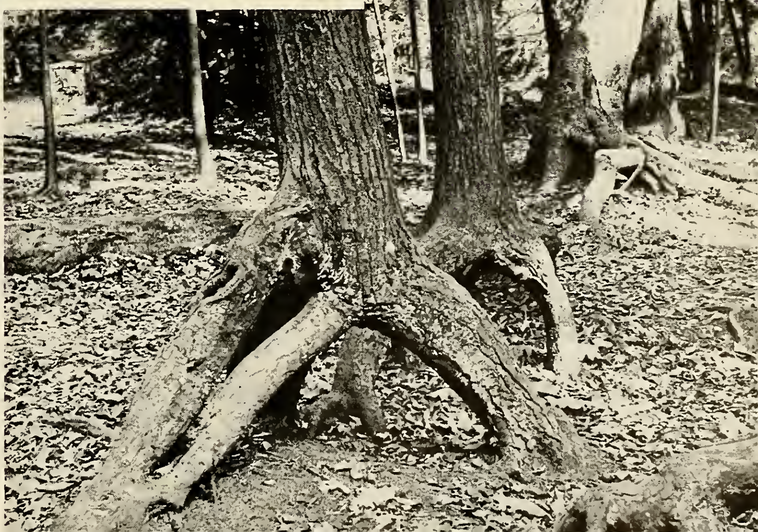
The first photograph shows a fairly common situation in which such trees as black birch, yellow birch, and hemlock manage to extend their roots along the surface of a rock upon which the seed fell, and eventually to reach the ground below.

The tree shown at lower left is not so easily explained. There seem to be two possible answers. The first is that it started on top of a small stump which was close to the rock; the stump finally rotted away, but not until a root had grown laterally over to the boulder. The other possibility is that the young tree grew in some moss at the edge of the rock and slowly shifted to its present position. However, it is quite possible that neither of these suggestions furnishes the correct explanation!

The trees in the two other photographs very evidently began life on an old, perhaps rotting log which has long since disappeared.



"From front and rear
I ape a dancer,
But why I'm arched
Is yours to answer."



Did these roots
Deny their birth
By springing upward
From the earth?

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DEATH OF A SCIENCE IN RUSSIA

- - - - - Edited by Conway Zirkle

University of Pennsylvania Press
$3.75, 319 pp.

THIS account of the perversion of the science of heredity in the Soviet Union is one of the most terrifying books ever written. Bombs kill only bodies. The killing of knowledge and of free enquiry is a far surer way to stop human progress and to enslave mankind. Ten or fifteen years ago it seemed incredible that such things could happen in a civilized country and in one that had, regardless of possible other faults, tended to value and to support true scientific research. Here is the damning record of intellectual murder and a display of the means employed, both subtle and brutal.

Apologists have represented the outcome as a result of open and democratic scientific discussion, and anti-communists have cited it as a simple example of police-state methods and dictatorial thought control. The detailed evidence shows that neither view adequately represents the process or the danger. A parody of scientific discussion was used to suppress rather than to seek the truth, the exact opposite of the procedure travestied. This was only one of the many methods used in a long struggle. The struggle was already lost before it reached the last stage of overt political control and open reprisals against those who failed to run to cover or to recant, publicly shaming the values for which they had lived.

Dr. Zirkle has supplied such background as is necessary for the nongeneticist to appreciate the issues and to follow the sequence of events. The bulk of his book consists of authoritative documents, mainly reports from *Pravda* plus some other statements by informed persons, such as the eminent geneticist Muller, who had realistically approved earlier Soviet accomplishments in science. The evidence is plain. The implications are so extensive, even outside the field of science, and so menacing to freedom of thought and of institutions that this book should be required reading for anyone honestly interested in human welfare.

The only serious editorial imperfection is the lack of a list of *dramatis personae* or an index.

G. G. SIMPSON

AN INTRODUCTION TO BIRDS

- - - - - - - - - - by John Kieran

Garden City Pub. Co.
$2.00, 77 pp., 99 illusts.

TO ONE who married the American Ornithologists Union 38 years ago, John Kieran's *An Introduction to Birds* comes as a blessing 39 years overdue.

The amateur is too often plunged into ornithology before having any chance to learn the abc's of birds themselves. The professional ornithologist is so far along in the disease that he rarely clicks with the beginner. The former knows so much that the layman regards him with awe. Writers try to emulate him, tucking in scientific names and descriptions.

Along comes everybody's John Kieran, with his courage and his humor, without self-consciousness among his ornithological pals. He tells, in clear language and with scholarly simplicity, how to know the birds.

"The first rule to follow if you want to know the birds is: Look at them!" says Mr. Kieran. One can add a second rule: Get Kieran's book.

There are 99 colored portraits of our whole country's common birds, with their approximate lengths in inches below their common names. Clear descriptions tell in what kind of setting each bird may be found—whether woods, fields, seashore, gardens. Songs are beautifully described, with particular appreciation for that of the hermit thrush: "lovely, liquid, dreamy, ethereal."

Kieran's style matches the charm of the birds he is sharing:

"The simple facts about Hummingbirds are like the birds themselves, almost unbelievable," and, "The flashing Tree Swallow that sweeps in chattering flight over our summer meadows. . . ." On every page there are such phrases. Poetry and accuracy are not always twins, but Mr. Kieran is a trained observer with knowledge of his subject as background for his sensitive appreciation and his gift for its expression.

The reproductions in color of Don Eckelberry's paintings are beautifully done. The book is both distinguished and delightful to own or to give away. The price is also delightful in these days of high-priced books.

GRACE E. BARSTOW MURPHY

PREHISTORIC SOUTHWESTERNERS FROM BASKETMAKER TO PUEBLO

- - - - by Charles Avery Amsden

Southwest Museum, Los Angeles
Paper—$3.50, cloth—$4.25
163 pp., 2 maps, 39 plates, 46 figs.

THE core of this publication is a comprehensive account of a once widely ranging, partly semisedentary people whose relics, dating from the first five or six centuries of our era, have been especially well preserved in the arid "Four Corner" region of the Southwest. They were called Basketmakers by their earliest discoverers in Utah, about 1890, simply to distinguish them from their Pueblo Indian neighbors who were expert potters. Their collected remains, both cultural and somatic, held a place of special importance for all regional archaeologists until traces of the much earlier and even more widely disseminated Folsom culture came to light in 1927. This temporarily dampened interest in the Basketmakers who, however, still retain the unique position of affording us our best American evidences of the gradual transition from the hunting to the agricultural mode of life.

Our author prefaces his subject with a prologue on the first peopling of America. He next devotes a chapter to a brief but glowing description of the Southwest, to its partial conquest and colonization, from 1540 onward, by the Spaniards, and

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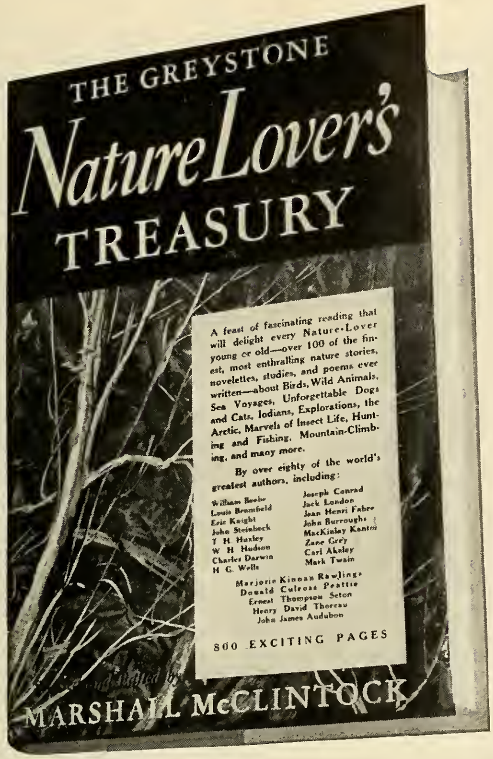

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to its more and more systematic archaeological investigation, mostly by Americans, from 1846 to the present day. Another chapter is added giving an intelligible explanation of the supplementary study of local tree rings which, applied to the timbers of both the inhabited and the long-abandoned Indian dwellings, has resulted in an absolute chronology for the region.

Six chapters of this book are devoted to detailed description and illustration of the principal traits of Basketmaker culture. These exhibit marked skill and taste in the manipulation of stone, shell, bone, wood, hide, hair, and clay, resulting in about 200 specific types of contrivances, answering to various requirements of the maker's activities. Among the features treated are dwellings and storage caches, articles of dress, personal adornments, ceremonial objects, human and animal paintings on suitable rock exposures, tools, weapons, household utensils, hunting gear; cultivated maize, squashes, and beans; domesticated dog and turkey; and, finally, the ceremonial disposal of the dead. This abbreviated inventory of more or less diagnostic traits did not, of course, originate all at once but was the result of improvements and additions ranging over more than half a millennium. The "improvements" may be ascribed to native ingenuity, but the "additions" were doubtless for the most part borrowed from neighboring tribes. This borrowing appears to have proved fatal, for in the end the culture lost its identity. The Basketmakers became Pueblos.

Mr. Amsden, now passed away, may not have left his aptly phrased and often illuminating treatment in its intended final form, but his colleagues and friends have checked it and supplied helpful and attractive illustrations, as well as a useful bibliography, and Dr. A. V. Kidder has added an appreciative Introduction.

N. C. Nelson

FREDERICK CATHERWOOD, Arch$^{\underline{t}}$

- by Victor Wolfgang von Hagen
Introduction by Aldous Huxley

Oxford University Press, $5.00
177 pp., 38 plates

IN the author's words, this biography of the nineteenth century architect, artist, and pioneer archaeologist is "an attempt to raise Frederick Catherwood out of the alluvium of the 'Stream of Time,' to cover him with flesh, and give him life." If one judges the book narrowly, and merely as an attempt to recreate a personality, Mr. von Hagen's effort does not quite succeed, but through

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no fault of his own. So completely has Catherwood been obliterated by time that no such recreation will ever be possible. Although he was an intimate of Keats, Shelley, Severn, Prescott, and Stephens, no journalist recorded his exploits and no artist painted his likeness. Indeed, the author was obliged to construct Catherwood's bare life history from bits and pieces drawn from Copenhagen, Cairo, London, and British Guiana.

Yet even the bald facts of Catherwood's incredible life are absorbing and worthy of record. Although he is justly famous for his magnificent drawings of the Maya ruins of Mexico and Central America, few are aware that Catherwood had also made firsthand studies of the ancient monuments of Italy, Greece, and the Near East. In addition, he was a pioneer Egyptologist of outstanding importance. If not actually the rediscoverer of Maya civilization, Catherwood and his colleague, John Lloyd Stephens, established its existence beyond all doubt and brought it to the attention of both scholars and the public. Between trips of archaeological exploration, Catherwood managed to practice his profession as architect in New York and elsewhere, to build the first railway on the South American continent (in British Guiana), and to participate in the California gold rush of 1849.

Mr. von Hagen has himself undertaken an "archaeological investigation" in assembling the facts of Catherwood's career from diverse and inaccessible sources. The book is a handsome contribution, and the numerous reproductions of Catherwood's drawings, and of lithographs and engravings based on them, are uniformly excellent.

Harry Tschopik, Jr.

AUDUBON'S BIRDS OF AMERICA

- - - - Introduction and captions by Ludlow Griscom

The Macmillan Co., $2.95
320 pp., 288 colored plates

APPARENTLY encouraged by the success of their earlier royal octavo edition of Audubon's paintings of the birds of America, Macmillan has brought out this "popular edition." It contains some 288 of Audubon's plates, each reduced to a size of about four by five inches. The color reproduction in this volume, it must be admitted at once, is about the worst imaginable. Plain black and white would have been better. The blues are particularly obnoxious, and all sorts of birds—fox sparrows, mockingbirds, Connecticut warblers—are tinted with bright blue! The other colors are usually too dull; the flaming crest of the ivory-billed woodpecker,

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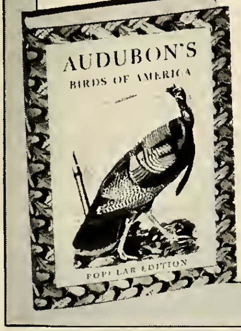

Ludlow Griscom, Chairman of the Board of the National Audubon Society, has written a splendid, new Introduction, as well as the concise descriptive text accompanying each of the 288 magnificent plates.

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—JOTHAM JOHNSON, *N. Y. Times Book Review*

Frederick Catherwood Archt.

By

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for example, is here a sickly brown. Of course, among 288 plates one finds some that are passable.

Ludlow Griscom has written a brief caption for each plate, giving the range, habitat, and status of the bird depicted. Since this information is available in so many other books, would it not have been better to quote a sentence or two from Audubon's own vivid "ornithological biographies"? In his general introduction Griscom makes it clear that the exaggerated and even grotesque attitudes of many of Audubon's birds were a symbol of his revolt against the stylized and unfeeling methods of portraying nature then in vogue.

This volume appeared shortly after two others in which a much smaller number of Audubon's paintings are much better reproduced. Comparison leaves no doubt that in things of this sort, quality is preferable to quantity.

Dean Amadon

THE INVASION OF NEW ZEALAND BY PEOPLE, PLANTS AND ANIMALS: THE SOUTH ISLAND

- - - - - - by Andrew Hill Clark

Rutgers University Press, $6.00
465 pp., 81 illusts.

HERE is an admirable and detailed account of the relation between man and environment in the world's most isolated and most rapidly made-over land. New Zealand is the newest abode of human beings, whether we refer to the Polynesian aborigines who first arrived about a thousand years ago or to Europeans who began to settle close to the opening of the nineteenth century. The earliest comers were exploiters in search of whale oil, fur-seal skins, native "flax," and timber.

Immigrants seeking permanent homes arrived in the South Island mostly after 1840. They represented, in large part, deliberately organized efforts to transfer a cross section of British society, with all the contemporary mores, to the antipodean outpost of the Empire. Professor Clark, who has had critical experience in the field, shows clearly how developments in land use have departed widely from the plans of the founders. More and more, the inhabitants have come to depend upon their own experience and initiative in devising the pastoral and agricultural practices upon which their economy depends. Despite the British heritage and the nostalgic introduction of countless plants and animals from "home," the very landscape in the densely occupied parts of the island now smacks more of California than of Britain. The universal shelter belts and clumps of Monterey cypresses and Monterey pines—far more majestic than in their own hearthland—are a case in point.

This book deals, in terms as precise and quantitative as the data warrant, with the struggles, the successes, and the mistakes involved in the creation of a new, prevailingly rural culture. The "invasion" has had many tragic corollaries, because scores of alien organisms have become devastating, almost hopeless, pests. Coupled with reckless overuse of natural resources, they have led to land deterioration that is a challenge to the outstanding scientific competence and the finally aroused popular sentiment of the Dominion.

R. C. M.

LITTLE MIKE *Continued from page 182*

shell shows distinctly animal characteristics. It has a long tail, or flagellum, by means of which it may swim freely, or it may creep like an amoeba. These tiny protoplasts multiply rapidly by division, forming a multitude of "swarm cells." After a time, these cells unite in pairs to produce miniature plasmodia similar to the larger one already described. From time to time, as they meet others of their kind, they continue to unite, forming larger and larger units; or the single "miniature plasmodium" may develop by itself until the full-grown organism is produced.

The slime molds are of little economic importance, though one species is parasitic on cabbage roots and causes some loss to crops of this vegetable. They are interesting

VENUS'S FLYTRAP

This carnivorous plant found only in S. E. North Carolina, now available as colorful novelty for home or as botanical specimen. May through July. Each plant shipped postpaid in own soil with simple instructions. Each $1.00. Six $5.00.

WILL REHDER, *Florist,* Wilmington, N.C.

chiefly as biological curiosities, as a sort of Dr. Jekyll and Mr. Hyde in Nature's underworld and, of course, for the attractive patterns formed by the plasmodia and the beauty and variety of the fruiting stages.

With the exception of *Fuligo*, the sporangia of Myxomycetes are so small that they easily escape the notice of all but the most observing persons. Would-be collectors should bear in mind that a single sporangium of *Arcyria*, *Physarum*, and many others is no larger than a capital letter in the type on this page, and that a plume of *Stemonitis* could easily be passed through a small "o." With this in mind, and after a study of the photographs accompanying this article, look for specimens attached to leaves, bits of bark and dead wood under old trees, or on rotting logs in the forest. The best time to find them is a day or two after a warm summer rain.

Plasmodia are rarely seen in the open. Slime mold enthusiasts usually obtain specimens by gathering bits of decaying wood, dead leaves, and forest litter. These are placed in covered glass vessels and kept moist and warm. Temperatures of 67 to 72 degrees F. are considered best. White blotting paper or pieces of paper towel may be placed under the material to facilitate observation. Then follows a period of watchful waiting, and hoping. Sooner or later a plasmodium may appear, spreading thin feelers out on the paper or onto the glass. It may be white, like Little Mike, or it may be yellow, green, tan, brown, orange, or even black. Whatever color, it brings elation to the slime-mold fan.

Plasmodia, as pets, require little in the way of care or attention. The principal requisite is moisture. Some collectors supplement the supply of natural food by sprinkling a small quantity of oatmeal flour into the enclosure once or twice a week. Under certain conditions, plasmodia may attain a ripe old age before changing to sporangia. One collector has a record of a specimen in captivity for nine years! A Myxomycetoid zoo can be fun.

LETTERS

THE MAN WHO READS IT

Continued from page 155

and are interested only in telling the truth, no matter how amazing it may be. There are delightful drawings and wonderful photographs that aid greatly in the reader's enjoyment and understanding of the text. In the course of time, a regular reader of NATURAL HISTORY Magazine is bound to obtain a liberal education in the natural sciences with no feeling of pain. It widens our horizon and adds much to our enjoyment of life to know these things. Knowledge of one thing in Nature leads to another, and the effect is cumulative; the more we learn, the greater becomes the desire to carry further our knowledge of Nature, the world in which we live, and the Universe around us. Walled in as we are now by great cities, monstrous housing projects, specialized careers, and man-made gadgets and contraptions, more than ever we need to realize our true place in the sun and our proper relation to the stars in their courses.

Of all men, I think the naturalist is the one who can roam the farthest, get most out of life, meet friends wherever he goes, and, in the words of Thoreau, let the night find him everywhere at home.

LETTERS

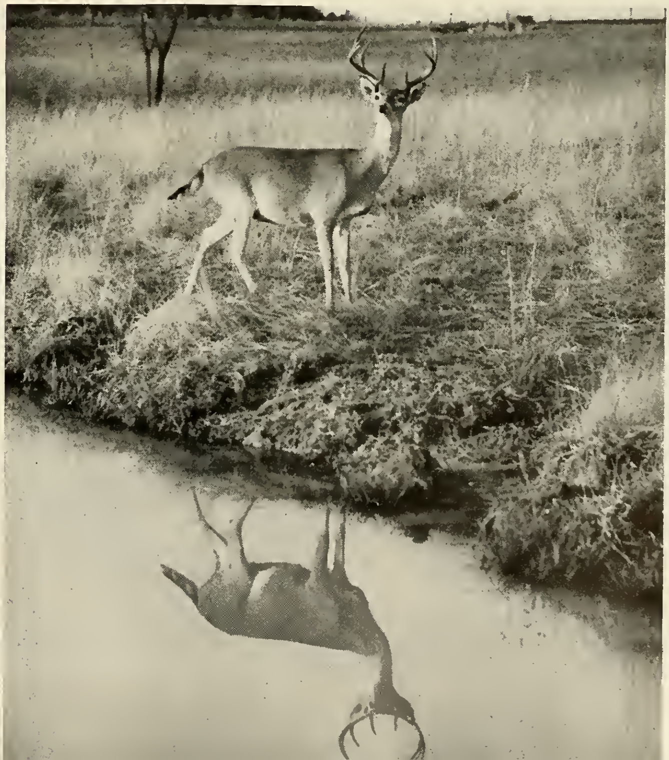
Stag at Eve

SIRS:

This photograph, which was taken near here in the late afternoon, reminds me of the first line of Scott's "Lady of the Lake": "The stag at eve had drunk his fill." So that is what I call it, and I hope readers of NATURAL HISTORY will like it.

MRS. THASE DANIEL.

Norphlet, Ark.



It's a Nutcracker

SIRS:

On page 98 of your March issue is a photograph of a bird that is identified as a Canada Jay in the letter accompanying it. It looks more like a Clark's Nutcracker to me, judging from the white patch in the wing and the lack of a black nape, though it *might* be an immature bird. The bill also looks as if it could not be that of a jay. Could you inform me regarding the picture? Incidentally, it is a fine photograph, regardless of the species, and yours is a fine magazine. I congratulate you on it.

PETER W. CASTLE.

Putney, Vt.

Mr. Castle is absolutely right, and we are serving a sentence of six months at hard nutcracking. —ED.

SIRS:

NATURAL HISTORY Magazine seems to grow more interesting each year. The article on the New Zealand Kiwi was read at our Stamp Club meeting the evening that our topic was "Birds on Stamps," and everyone found it interesting and amusing. My copy of the Magazine eventually goes to the local TB Sanatorium, where it is read to pieces, from all accounts. Everyone exclaims over the beautiful covers.

IDA M. LUTHER.

Norwich, Conn.

SIRS:

Among the innumerable letters that you receive, will you accept a modest tribute from me. I have under my eyes the whole collection of NATURAL HISTORY for 1949, and I must say that it is a veritable enchantment. With its harmony of colors and its scientific text, NATURAL HISTORY Magazine is a pure marvel which, in this painful era, puts a charming bit of poetry into our otherwise disillusioned hearts.

ALPHONES O. RENAUD,
Trumpeter in Jazz,
Composer of Music

Bordeaux, France

SIRS:

Just received our copy of NATURAL HISTORY Magazine for March, 1950. It is one of the finest issues I have ever seen, and I have all the copies since 1922. Every article in this month's issue has a very special appeal to me . . .

I am enclosing my check in the amount of fifty cents for which kindly send me another copy of this issue of NATURAL HISTORY.

You are to be congratulated for issuing such a wonderful magazine. Long may it be published under your editorship.

E. B. POWERS.

San Diego, Calif.

SIRS:

One or more red-tailed hawks could recently be seen spread-eagled on fences in three different but adjacent counties in California. In each case, the farmer retorted "chick hawk." So here are three startling examples of biological illiteracy, as will be seen by the last four words below.

In one of the above counties the writer had a bottomland ranch. Some 40 years ago, neighborhood farmers held a "hawk-and-owl shoot." They very systematically cleaned out both birds over a considerable area. Next year, the very prolific ground squirrels, being free from predator interference, raised numerous young.

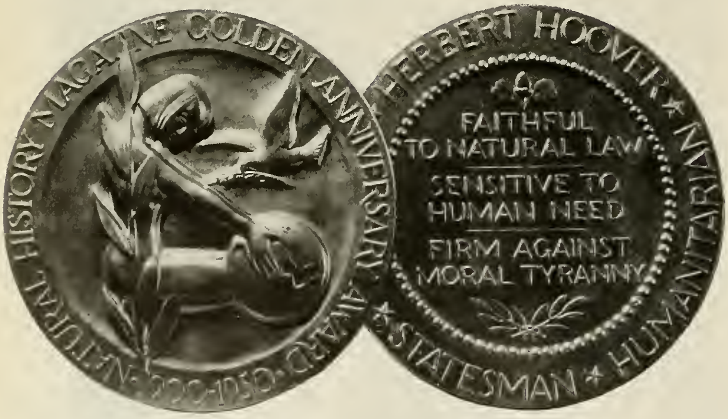
That winter came one of a lifetime's copious floods. The levee, during the summer, had been honeycombed with squirrel burrows. It crevassed under flood pressure, and sand was deposited over much of the writer's land. It was quartz sand from the tailings of gold mines upcountry. The ranch thus became a partial desert. Quartz sand does not rot, so soil-making proceeds painfully slowly. Now, after 40 years, we are starting to harvest the first beginnings of crops.

California scientists made a study of this hawk's food habits and analyzed 2,094 ejected food pellets. These showed 1,049 ground squirrels, 794 gophers, 322 rabbits, 14 jays, 70 rattlesnakes, 776 other reptiles. "NO POULTRY WAS FOUND."

C. M. GOETHE.

Sacramento, Calif.

Medal awarded to Herbert Hoover by Natural History Magazine on its 50th Anniversary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Each visitor to the Planetarium's new production, "Conquest of Space," will be given opportunity to make a reservation for one of the first actual rocket ship passenger flights. The applications, issued at a simulated interplanetary terminal reservation desk, will be kept in the Planetarium's archives and will be turned over to the first organized passenger service to the moon, Mars, Jupiter, and Saturn. In the Planetarium production, visitors will have a thrilling "preview" of the sort of inspection tour of the solar system that science may make possible in the not-too-distant future; and the original paintings by Chesley Bonestell for Willy Ley's recent book, *Conquest of Space*, will be on display during the run of the production.

Special Jewelry Display

An unusual exhibit entitled "Silver and Gold with Stones" will display the artistry of a young designer, Yonny Segel, in the Morgan Hall of the American Museum until May 10. Mr. Segel explores the use of uncut stones and emphasizes the design principles that are currently applied in painting, sculpture, and architecture. His sculpture has been exhibited in various museums and galleries, including the Metropolitan Museum of Art and the New School for Social Research. He is now teaching jewelry and plastics to severely disabled veterans at an outpatient clinic of the Veterans Administration and is studying for his doctorate in Education at New York University.

May NATURAL HISTORY *195*

Mountaineering Adventure • White Sands • Sea Otte

imics in the Wild • Animals of the Avalanche • Vicuñ

LUME LIX No. 5

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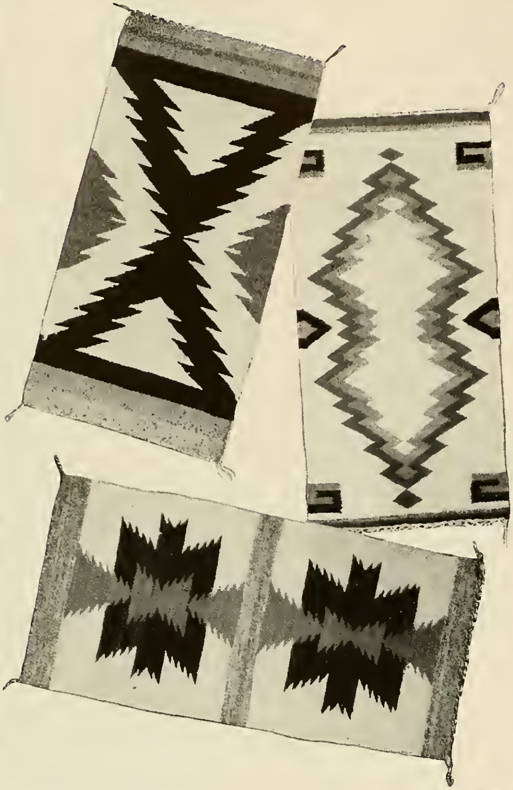

NAVAJO Throws

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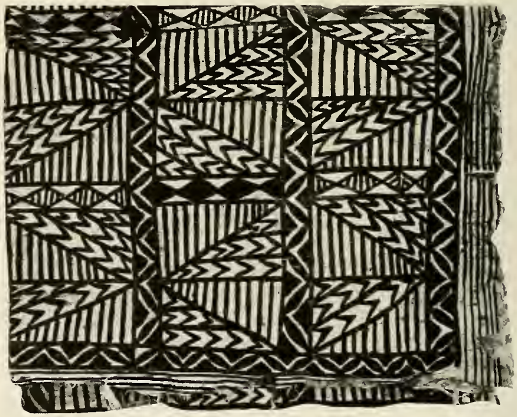
THESE are small throws, or rugs, made from wool. The colors employed are the natural white and brown of the well-washed wool, a gray which results from the mingling of these, and various native and commercial dyes. Black is produced by combining a concoction of sumac (*Rhus aromatica*), roasted ocher, and piñon gum. Dull red is obtained by placing the yarn in a liquid made by boiling the bark of alder and mountain mahogany in water. However, in general, commercial dyes are used today, and it would be wise to have them dry-cleaned rather than washed with soap and water. The designs are generally in squares, parallelograms, diamonds, and triangles. Although it is assumed that the Navajos, who formerly did not weave, learned the art from their Pueblo neighbors, the practice of making designs in colors that do not cross the entire width appears to be their own invention and probably derives its origin from their basketry designs.

TAPA CLOTHS

63" x 63" *$8.50 each* *postage 15¢*

WE have a new stock of these tapas, from Samoa. They are made from the bark of the mulberry tree, pounded under water into pulp, dried, and hand painted with the juice of berries. The designs are varied in assorted shades of brown, and the cloths are suitable as wall decorations or table covers.



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LETTERS

Snowsuit Without Snow

Sirs:

Your readers might be interested in the story connected with the accompanying photograph of a weasel, wearing his winter coat at a time when there was not a trace of snow on the ground.

We were following a trail through a stand of lodge-pole pines in southeastern British Columbia last October 30, when I saw this beautiful animal running through the down timber toward the trail ahead of my lead horse. He flowed over the logs like a ribbon of white silk, and on reaching the trail, stood up like a tenpin to look at us curiously. I stopped the pack train to watch him. As though dissatisfied with his view from the ground, he took to a tree to give us a good looking over.

He paid little attention to me when I dismounted and walked closer with my camera. He continued to gaze curiously at the rest of the outfit while I photographed him from about eight feet.

To me, one of the most fascinating aspects of nature is the phenomenon of protective coloration, and this weasel is pictured in the embarrassing position of being clothed in his beautiful white coat without benefit of snow. He showed up in startling contrast to his surroundings.

This picture has additional significance, to which I should like to draw your attention. I am an outfitter and guide, and we are all aware that this profession has long been considered synonymous with the killing of game; but I have introduced a new angle, which has provided endless enjoyment and aroused a growing interest among my friends. I am introducing camera hunting and have induced many to learn of the sport of shooting with film instead of bullets. And I am striving to show the men who follow my profession that, because shortened seasons and smaller bag limits are slowly cutting into the income of guides everywhere, camera hunting provides a wonderful opportunity to increase popular interest in the outdoors and to extend the opportunities through a greater portion of the year.

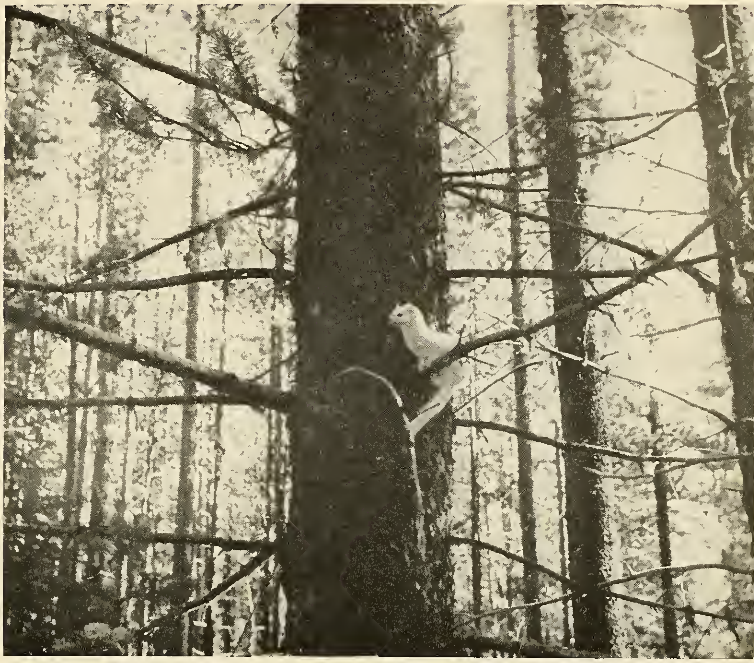
Andy Russell.

Twin Butte, Alberta, Canada.

Nature Lovers in the Netherlands

Sirs:

I was delighted to see how many of your readers responded to the notice you published suggesting that young nature lovers might like to correspond with members of the Dutch Youth Association for Nature Study. Many letters have reached us. Not only that, but we were pleased to receive some copies of Natural History and even a gift subscription and membership in the American Museum . . .



This summer, between July 3 and 13, we will have an international field-biology camp at the isle of Terschelling. Though we understand that it won't be easy for Americans to come and attend it, we would be delighted to be able to welcome some of them at this wonderful spot in Holland. The age limit for both boys and girls will be from seventeen to thirty years . . .

Hans Andreae.

Leiden, Holland.

Though the camp quota may be full by the time this goes to press, interested readers can obtain further information by writing promptly to Natural History Magazine, 79th Street and Central Park West, New York 24, N. Y.—Ed.

What Is a Robin?

Sirs:

After reading the well-deserved tribute to your Magazine in the April 3 *Time*, it occurred to me that you might be willing to help me and some of my friends in a matter that has bothered us for years, namely, what bird is the true robin.

I am aware of Webster's definition of robin—"a small European bird *(Erithacus rubecula)* of the thrush family," etc., and 2, "In North America, a kind of large thrush (*Tardus migratorius*)," etc. However, this still leaves us with the question as to whether the North American bird is truly a robin or whether it is just so called because it resembles the European bird. . . . And if we must, because of usage, accept the name "robin" for our American bird, is it actually related to the real robin?

To make the subject even more complicated, I lived for some years in the Pacific Northwest, where there is a most lovable and beautiful bird known there as the Marsh Robin. It resembles the European robin much more than the American, but it has a longer tail than either and a redder breast. Many people there consider this bird the real robin, and I can't blame them, because I know of no feathered creature more admirable . . .

Robert B. Woolverton.

San Francisco, Calif.

The following comments are offered by

Dr. John T. Zimmer of the American Museum's Bird Department:

Suggestions are occasionally made that our Robin has no right to that name since it properly belongs to a different European species. While the latter part of the statement is true, the name has become so firmly fixed to our bird that it would be difficult to supplant it by another term, even if it were desirable, which is a debatable point. Our Robin was presumably so called by the early English colonists who saw in it a certain degree of resemblance to the well-loved bird of their homeland, and they transferred the old name along with some of the old affection.

It has borne other names in its day: American Fieldfare, Red-breasted Thrush, Fieldfare of Carolina, American Redbreast, and Migratory Thrush. But "Robin" has emerged victorious and is likely to remain. The English bird itself was long called Redbreast in more formal writings, and the affectionate diminutive of "Robert" was added in popular writings and everyday speech to make "Robin Redbreast," possibly in the same vein as "Jennie Wren."

Other birds of the New World were also given names that originally were reserved for European birds. Oriole, Redwing, Tree Sparrow, Redstart, Warbler, Blackbird, and Flycatcher, to cite a few general and specific terms, were given here to birds that are even of different families than the European birds they were thought to resemble. Others, like Goldfinch and Robin, belong to members of the same families, though of different species. When we wish to distinguish the European birds in question, we are likely to prefix "English," "British," "European," or "Old World," while the British, in the same way, call our birds "American Robin," "North American Goldfinch," and the like. As a matter of fact, they call their own Robin the "British Robin" because of the existence of other subspecies on the Continent, one of which reaches the British Isles in winter.

A more troublesome difficulty arises when we and the British use different names for the same species. The respective committees of the British Ornithologists' Union and the American Ornithologists' Union have been attempting to compose some of these differences, and considerable progress has been made, so that greater uniformity is in prospect. There is no need, however, to change the name of our Robin to one of its ancient synonyms or to invent a new term to replace it; and I, for one, hope that no such proposal will seriously be made.

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Watch for Marked Butterflies

The Monarch Butterfly, which ranges over practically all the Western Hemisphere, migrates long distances seasonally. Again this spring the monarchs will be flying north once more. An effort is being made to gather information regarding the migration routes, and toward this end the wings of butterflies in Texas have been marked. Readers of Natural History are asked to keep an eye open for butterflies whose wings bear numbers or other marks. Please report any discovery of marked wings to C. A. Anderson, 3209 Centenary, Dallas 5, Texas. He wants to know the kind of butterfly, the number or other mark, the place, the date, and any other pertinent information. Release the butterfly after examination.—Ed.

Golden Anniversary

Sirs:

The Golden Anniversary issue of Natural History is excellent; in truth, every issue is read by my husband and me with much interest, and there is always a race to see which of us gets hold of the Magazine first!

Your editorial, "It's for You to Choose," is a classic in literature. The subject matter is most apt for the moment in history, the way you handled it is superb, and the inspiration—well, it was too good not to pass on, and I have just suggested to the Editor of the *Atlanta Journal* that he should reprint it . . .

Mrs. Athos Menaboni.
Atlanta, Ga.

Sirs:

Enclosed please find check for $5.00 for which please send us ten copies of the April 1950 Golden Anniversary number of Natural History. We have in mind to use the copies to deepen the interest in natural history, and perhaps there may be a new regular reader for the magazine.

This order is our testimony of appreciation for your Golden Anniversary number. Every single one of its pages deserves a "Thank you." But we wish particularly to commend Edward M. Weyer, Jr. for his editorial, "It's for You to Choose." . . . Our good wishes reach toward you in your ministry of education.

Robert H. *and* Ruth O. Maris.
Wilmington, Del.

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Sirs:

I want you to know how deeply moved I was in reading "It's for You to Choose" in the April issue of Natural History. This editorial should be read by every legislator and minister in the United States. Thanks for putting it all so clearly in so few words.

Mrs. Leonard H. Gidding.
Plainfield, N. J.

Separate copies of "It's for You to Choose" can be procured at 5¢ each or 25¢ a dozen.

Sirs:

Congratulations to Natural History Magazine on its Fiftieth Anniversary and to its able editors and contributors. May the Magazine always be a cheerful monthly visitor to our many homes and continue to bring pleasure and worthwhile knowledge.

E. B. Powers.
San Diego, Calif.

Sirs:

May I comment that I personally consider Natural History Magazine one of the best that comes into my home. We subscribe to seventeen magazines (which we turn over to friends or to the hospital after we have reviewed them), and there are only two in this list that I read with regularity. One of them is the American Museum's Magazine, which you can see I consider tops. The articles are invariably on subjects that are interesting, and they are always brief, instructive, and very well written.

Dudley S. Ingraham.
The E. Ingraham Company,
Bristol, Conn.

"Man in Whale"

Sirs:

I was pleased and amused to see that "we" made *Time* Magazine [April 3] together. Hope it is no source of embarrassment. Had never intended it as such.

Continue to love your Magazine—pine aroma and all.

Your obedient servant,
Egerton Y. Davis, Jr.
No address.

Readers will be reminded of the letter entitled "Man in Whale" published in Natural History in June, 1947, and its sequel in September. Not yet having been able to ascertain the whereabouts of Egerton Y. Davis, Jr., we take this method to inform the good "surgeon" that he did not cut us up any more seriously than he did the whale. The wounds have healed nicely.—Ed.

NATURAL HISTORY

The Magazine of the American Museum of Natural History

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Albert E. Parr, Director

VOLUME LIX—NO. 5
MAY, 1950

Green-clouded Swallowtail ....Cover Design
A study of a butterfly from a Kodachrome by Chris Olsen

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This little "camel," whose superfine wool has been the pride of kings, may provide the basis for a new industry

Clown Fish ....Woody Williams 208
Nursemaid for a vicious "sea flower," this gorgeous little fish enjoys the safety of a well-armed castle

Animals of the Avalanche ....Tom McHugh 210
Four furry alpine animals will soon emerge from their snowbound homes to enjoy a brief season of sunshine

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A study in feather arrangement

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The gripping story of how a band of scientific explorers forced the Flaming Terror of the Andes to yield its secrets

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Many unarmed creatures have bought security cheaply

The Great White Sands ....Nell Murbarger 228
Our most extraordinary desert beckons those who seek the truly bizarre

More Sea Otters 236
Under a protective eye, these fabulous "old men of the sea" are returning from the verge of extinction

A Shaggy Tree ....Dorothy Freas 238

You will find Natural History *Magazine indexed in* Readers' Guide to Periodical Literature *in your library*

THE COVER THIS MONTH

The Green-clouded Swallowtail is a familiar butterfly of our fields and gardens. The green clouds appear only on the hind wings of the male. The female has blue clouds instead. In this sense, the popular name might be called misleading. Another name for this butterfly is the Spicebush Swallowtail, resulting from the habit of its caterpillars to feed on the leaves of spicebush. But again there is a difficulty, for the caterpillars like sassafras just as well. Linnaeus, nearly 150 years ago, called this butterfly *Papilio troilus*, after Troilus, the son of Priam, king of Troy, whose story is told by Homer in the Iliad. Really, "Troilus Swallowtail" seems to be the best name of all. The caterpillars are colorfully patterned when fully grown, with eyelike spots on the deep green body, on either side of the thorax. They make tubular nests by curling a leaf about themselves for concealment. The Troilus Swallowtail may be found in most parts of the Mississippi Valley and eastward.

William P. Comstock.

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YOUR NEW BOOKS

Nature of Natural History • Maine Woods
Nature Crafts • American Horticulture

CONGO EDEN

- - - - - by Mary L. Jobe Akeley

Dodd, Mead and Co., $5.00
356 pp., 27 illusts.

CONGO EDEN is the story of Mary L. Jobe Akeley's return visit to the Kivu District of the eastern Belgian Congo, after an absence of 20 years.

In 1921, Carl Akeley had first visited this scenic region of volcanic mountains and heavy forests. He headed an expedition to collect specimens of the mountain gorilla and also the accessories for a group of this animal for the new African Hall, now known as the Akeley Memorial African Hall, in the American Museum of Natural History. He returned to New York very enthusiastic about the country, which he often referred to as "the most beautiful spot on earth." His chief desire was to have these mountains remain unspoiled and their unique flora and fauna saved for posterity. It was largely through his influence that, in 1925, the Albert National Park, the first of the new famous National Parks of the eastern Belgian Congo, was created. In 1926, one year later, Mrs. Akeley accompanied her husband into the Kivu District for the purpose of making additional studies and collecting more accessories for the Gorilla Group, which was nearing completion. While undertaking this task, Carl Akeley was laid at rest in the very spot he cherished so dearly. Fortunately he had seen the beginning of his great ambition—to save the beauty and grandeur of these mountains.

The task of finishing her husband's field work fell upon Mrs. Akeley, and she most ably accomplished it.

In 1946, 20 years after Mary L. Jobe Akeley's first visit to the Kivu, she received an invitation from the Belgian Government to be their guest on a tour of the National Parks in recognition of Carl Akeley's interest in their foundation. The tour would also include a visit to her husband's grave. The invitation was accepted, and *Congo Eden* is her story of this trip.

Mrs. Akeley writes most informatively of the many happenings, including her trip through the Ituri Forest with its pygmies, and her many experiences in photographing big game. She gives interesting facts about the animals, describes the strange types of flora observed, and tells of the interesting people she met. She dwells at length on the accomplishments of the Belgian Government in educating the natives and in the development of agriculture. There are descriptions of the volcanoes and a chapter devoted to her visit to her husband's grave.

Mrs. Akeley has written with her usual easy-to-read, instructive style. I enjoyed the book and am glad to recommend it.

T. DONALD CARTER

A HISTORY OF HORTICULTURE IN AMERICA TO 1860

- - - - - - - - - by U. P. Hedrick

Oxford University Press, $7.50
551 pp., 62 illusts.

DR. HEDRICK'S retirement from the directorship of the New York Agricultural Experiment Station a dozen years ago meant merely a redirection of his activities, which since then have found expression in a series of books. This latest one shows that the passage of 80 seasons has not blunted the enthusiasm of its veteran author. He has ranged widely, gleaning here and there, and has collated his notes into a well-planned survey of early horticulture in the United States (rather than America). The book is as readable as it is informative and will be of value not only to horticulturists but also to students of our national development.

In sweeping over such a wide field, it was perhaps impossible to achieve complete coverage or complete accuracy, but there are some surprising omissions, such as the first Flower Show (Philadelphia, 1829) and the first book on botany (Adam Kuhn's, 1803) or the subsequent course of these subjects. The dahlia is mentioned but not the equally American and more popular marigold or zinnia; also the mulberry but not tea. The invention of the commission box of packeted seeds is rightly attributed to the Shakers, but on a later page to D. M. Ferry 60 years afterwards. Actually the man who promoted the Shakers' idea was William G. Comstock of Wethersfield, Conn., who rode the frontiers with his seed boxes in a wagon. The repeated story of the introduction of sweet corn into New England by Lieut. R. Bagnal has been shown by Erwin of Iowa to be a myth. In the phenomenal rise of this crop the pioneer breeding work in 1836-44 of Judge Noyes Darling, Mayor of New Haven, has been overlooked. The Jerusalem artichoke got its misnomer not from *girasole* but from London hawkers crying it as Ter Neusen, where the crop was grown.

The bibliography is ample but strangely omits Bailey's Cyclopedia of Horticulture, to which the author was clearly indebted. Still, when we have so much in this book, it is almost captious to notice the flaws rather than the excellences with which it abounds. A word of praise is due to the Press for the design and production of a volume which augments its high standards.

F. C. COULTER

THE MAINE WOODS

- - - - - by Henry David Thoreau

Edited by Dudley C. Lunt.
Illustrated by Henry Bugbee Kane

W. W. Norton, $3.00, 340 pp., 72 illusts.

ON the last day of August, 1846, Henry Thoreau left his cabin at Walden Pond for the first of three trips to the Maine wilderness. At the time of his death, in 1862, he was shaping his journal entries and essays into a book, *The Maine Woods*. Edited by his friend, William Ellery Channing, the volume appeared two years later, in 1864.

It has since reappeared in many editions. The most attractive of all, in a number of ways, is the latest, edited by Dudley C. Lunt and illustrated by Henry Bugbee Kane. In previous editions, the book consisted of three separate essays, covering the three trips. By "using the

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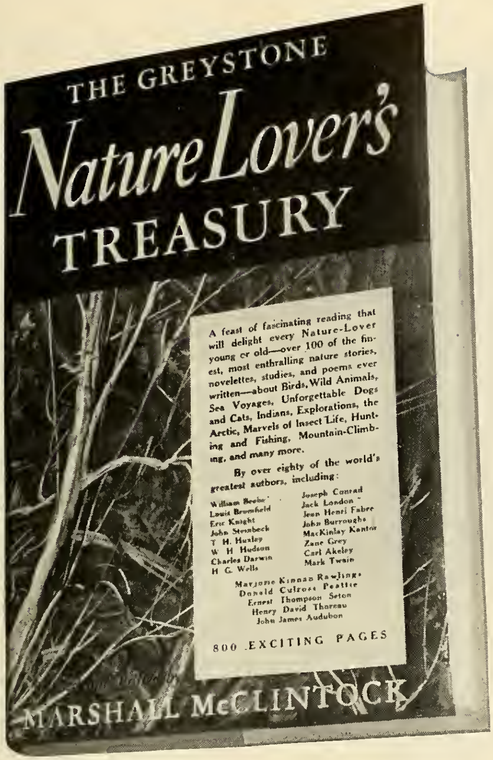

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route followed by the river trip of 1857 and dovetailing into it at the appropriate places the 1853 excursion to Chesuncook and the ascent of Ktaadn in 1846," the editor of the present volume has produced a more consecutive book, smoother to read and ending in the natural climax of the Ktaadn ascent. The gifted Mr. Kane, many of whose Kodachrome pictures have appeared on the covers of NATURAL HISTORY Magazine, has contributed more than 60 black-and-white drawings, 15 of which are given full-page display. In their wide variety, they combine to a remarkable degree dramatic art and the accurate delineation of scenes and wildlife.

While *The Maine Woods* is less philosophical than Thoreau's masterpiece, *Walden*, it contains some of the best forest writing in print. An American poet, recipient of the Pulitzer award, recently told me he considered one short paragraph in the book, describing the sound of a falling tree in the forest, as the most nearly perfect paragraph he knew. You can find it on page 70. In *The Maine Woods*, Thoreau, far in advance of his time, made the first eloquent plea in American literature for wilderness conservation. "Every creature," he wrote, "is better alive than dead, men and moose and pine-trees, and he who understands it aright will rather preserve life than destroy it."

EDWIN WAY TEALE

NATURE CRAFTS

- - - - - - - - - by Ellsworth Jaeger

The Macmillan Company, $2.49
128 pp., 70 plates

This attractive little book was prepared for campers, outdoor students, and those thousands of persons who are taking training courses in outdoor leadership. Along with schools, universities, churches, state and national parks, many museums are now providing nature courses. Ellsworth Jaeger, Curator of Education and Hayes Professor of Sciences at the Buffalo Museum of Science, has long been interested in nature crafts. This book is replete with easy-to-understand drawings by Mr. Jaeger and simple directions for the making of over 70 interesting nature craft projects. Mr. Jaeger carries on the tradition of Ernest Thompson Seton by interpreting nature through both word and picture.

The shops that supply craft materials may not be too pleased with a book of this type, for all of the materials used to produce the projects come from the fields, woods, and even vacant lots. Nor will the reader need to equip himself with a large assortment of tools. In addition to a pocket knife, only a few tools are needed, such as an ax, a saw, a bit and brace, a gouge, and scissors. Many of the projects are functional, such as a thatched hut, benches, stools, mats, spoons, gourd dippers, fish hooks, fire makers, turkey callers, candles, match holders, and snowshoes. Other nature crafts provide projects of the recreational type, such as equipment for games like lacrosse and snow snake, the carving of totem poles and Indian dolls, and the modeling of animal figures in clay. This is a crafts book of first quality, which will introduce many readers to a functional and satisfying aspect of their natural surroundings and provide many hours of pleasure. It should be a stimulating antidote for the artificial character of our mechanized and vicarious mode of life.

John R. Saunders

AMERICAN WILD FLOWERS

- - - - - - by Harold N. Moldenke

D. Van Nostrand Company, Inc., $6.95
453 pp., 88 full-color photographs,
67 in gravure

WE have on hand the first volume of "The New Illustrated Naturalist," and it is quite appropriate that this should take the form of a nation-wide treatise on flowering plants. This book represents a very considerable undertaking, for Dr. Moldenke estimates that 30,000 species of flowering plants grow in North America north of the Rio Grande.

He first conducted a nation-wide poll to find out what were the most popular native plants. It will not surprise anybody to know that the cardinal flower and the showy lady's slipper headed the list. Various regional floras were abstracted for descriptions of the interesting, more or less spectacular species that visitors or tourists are likely to find. These plants are described under family headings to give the book scientific integration. Fifty such chapters form the main text, beginning with "Buttercups and their Relatives" and ending with "Orchids."

Some of the Kodachrome illustrations are better than others; the unevenness in quality is probably due to the fact that they have been taken by a large number of people. The black-and-whites are uniformly good, with a fine soft contrasting background, those of the elk grass and Indian pipe being especially handsome. Running comment in these chapters provides information about the plants—how they grow, various types of pollination, their uses, and their geographic distribution. There is an extensive bibliography.

The amateur botanist, for whom the book is intended, may be surprised at the number of scientific names that appear unfamiliar. The author explains in an introductory statement, "Further study has shown the advisability of dividing an old genus of perhaps a great many discordant elements loosely held together by a single or but a few tenuous characters into several smaller but more homogeneous genera." The diversity of names that has resulted is a phenomenon not limited to the botanical field. Then the agglutination of common words into compounds is at times disconcerting—words such as "midasears," "Floridamimosa," "falseindigos," "jobstears," and "adobelily." Nevertheless, the book is beautifully set up, with excellent paper and printing, and the 2000 plants that are discussed will provide a sufficient background for the most insatiable amateur.

Henry K. Svenson

THE NATURE OF NATURAL HISTORY

- - - - - - - - - - by Marston Bates

Charles Scribner's Sons, $3.50
309 pp.

THIS is an excellent book, strongly recommended to all readers of Natural History Magazine and still more enthusiastically to anyone who may think that natural history is no concern of his.

Since the days of Darwin, Wallace, another Bates (Henry Walter, of Amazonian fame), and the other great naturalists, natural history has been transformed in two directions. The scientist has largely ceased to be a naturalist and has become an ecologist, a mammalogist, a paleontologist, or some other highly special sort of -ologist. To the amateur and the popularizer, natural history has become mainly "nature loving" and its literature is too largely of what Marston Bates calls the "oh my!" variety.

Now Bates proposes to pull natural history together again. For the scientist, here is a large common field among many -ologies, all of which gain by their contribution to a broader synthesis of studies of plants and animals as individuals and in associations. For the amateur, Bates hopes to supplement nature loving with nature *understanding* and to replace "oh my!" with "why?"

This is a tremendous field to cover. Among many other things, it includes the naming and classifying of organisms, their history, their reproduction and development, their environments, their associations, their behavior, their geographic distributions, their adaptations and evolution, and their importance in human economy. The facts are, of course, greatly simplified and generalized in covering so much in one book, but they are never essentially falsified and a real feeling for their trend and significance is conveyed. Moreover, the reader is given a stimulating personal experience. He learns much of the reasons and methods of biological science and of its meaning for him.

All this is conveyed in language so clear that anyone beyond (and some in) grade school should be able to understand it, but so free of condescension that the highest or most learned intelligence will not be insulted.

G. G. Simpson

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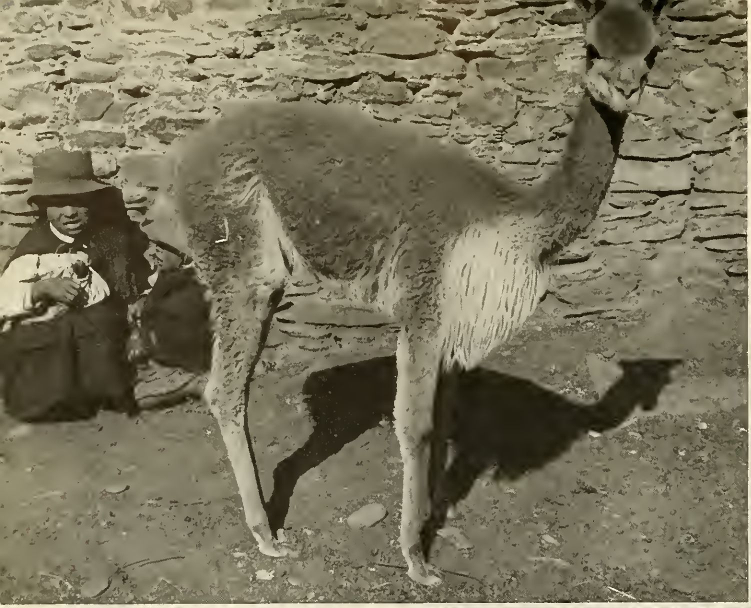


▲ THIS VICUÑA, now grown, was captured with its twin at two months of age when its mother was shot. The photograph shows well the ruff of long hair below the neck

➤ VICUÑALAND: high pampa country at 15,000-foot altitude in southern Peru. This scant, semiarid vegetation typifies the homeland of the little prince among camels. The old volcano El Misti, in the background, lifts its snowcap to a height of 19,110 feet

The little "camel" known as the vicuña, whose superfine wool has been the pride of kings, may provide the basis for a new industry

By WALTER HENRICKS HODGE

University of Massachusetts

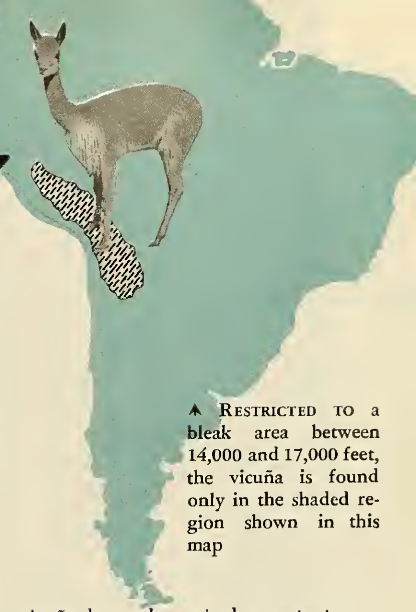
Photographs by the author except where otherwise credited

UNLIKE the mythical fleece of Jason, no sleepless dragon guards the haunts of the vicuña, the little Andean beast with the Golden Fleece. Nor need one be a mythological Jason to quest for this regal fleece. Yet only one person in every four million enjoys the beauty and warmth of fabrics woven from the golden-brown wool of the vicuña. Why? Because of scarcity of supply. Though the vicuña may become a plentiful animal under domestication, you may now have to pay upward of $1,000 for a garment made of its wool! Little wonder that most people have never heard of the vicuña, a little camel that often has been called the prince of wool bearers.

This is unfortunate, for the fleece of this animal surpasses in fineness that of any other. A single vicuña hair is less than one-half the diameter of the hair of the finest strains of sheep. Beside it, a human hair would look like coarse wire. Indeed, vicuña is to wools what chinchilla is to furs. It is truly "the most beautiful textile fiber." It is not surprising that this golden fleece, so fine and so regal, was originally reserved exclusively for royalty—the Incas—or that at the time of the Conquest, the Spaniards had a royal quilt made as a gift for their sovereign, Philip II.

Vicuñas, like their close relatives the more familiar llamas, guanacos, and alpacas, are South American camels (Camelidae). Although camels are generally thought of as Old World animals, their ancestral dwelling place actually encompassed large parts of North America,

Fleece of the Andes



▲ Restricted to a bleak area between 14,000 and 17,000 feet, the vicuña is found only in the shaded region shown in this map

on whose broad plains they developed in large numbers from 12 to 58 million years ago (Eocene to Miocene times). These prehistoric North American camels looked more like their modern South American descendants than like the ungainly humped creatures of Africa and Asia. By the end of the great Ice Age (Pleistocene), camels became extinct in North America but not before they had migrated into the Old World and also into South America, where they evolved through the centuries into two now widely separate and superficially distinct types of creatures.

The vicuña (*Vicugna vicugna*) is the handsomest of our Western Hemisphere camels. It is also the smallest (only two and a half feet high at the shoulders) and the most graceful, being deerlike in appearance and movement. Despite its delicate appearance, the vicuña is actually the hardiest of the Andean camels. Llamas and guanacos cannot stay long at the bleak, blizzard-swept altitudes inhabited by these creatures. Only the alpaca can wander occasionally into these heights. Indeed, save for the rare little deer called *taruga*, vicuñas are the only large mammals in their mountaintop abode.

The vicuña's haunts include the veritable heights of the Andes. Only the line of perpetual snow and ice (which effectively bars the upward growth of animal pasturage) keeps this little camel from clambering above about 17,000 feet on the slopes of some of the loftiest peaks in this part of the world. Wedged in between the snow line on the one hand and the upper limits of crop cultivation on the other (approximately 14,000 feet) lies the belt that the vicuña can call home—a cloud-scraping homeland that averages considerably higher than the summits of Pike's Peak, Mt. Rainier, or the Matterhorn! This treeless land is called *puna*. It is a sort of Andean tundra, with extensive rock fields or semibare earth. It supports sparse bunch grasses called *ichu*, curious mounds of cushion plants, and, in the poorly-drained hollows, vivid green moors of short rushes. These moors serve the vicuñas for herbage, and it is around them that the animals are most frequently seen, particularly in the dry season (April to December).

A Visit to Vicuñaland

Today one can climb by automobile into many parts of the puna country, and if lucky, one can catch a fleeting glimpse of these "substratosphere" camels. But to stalk them away from the road across the high pampas is another matter. Even on the level, the breath of the average person, in an atmosphere drained of life-giving oxygen, comes in short gasps. *Soroche*, or mountain sickness, except for the barrel-chested, big-hearted highland Indians, is an ever-present worry. Like the Indian, the vicuña is attuned physically to life at high elevation. So specialized is this creature that if transferred to sea level it often sickens and dies.

One might think that in a treeless area where the highest bunch-grass clump is scarcely two feet high, vicuñas would be easy to see. On the contrary, except when in motion or when silhouetted against the sky, they are practically invisible, so well does the color of their fleece blend into the perennially-drab brownish aspect of the puna.

The coats of llamas and alpacas, through endless selection in domestication, have become diversified so that one sees various combinations of browns, blacks, grays, and whites. But the undomesticated vicuña has only a single constant color pattern. This is so beautiful a gradation of hues that when fabricated it is rarely dyed. Rich chestnut-brown is the dominant color covering the upper parts of the head, neck, back, flanks, and legs. As it passes to the underparts, this hue is diluted to a soft, golden fawn color and finally to white on the belly and the inside of the thighs. Also light is the short wool of the jaws and face. But perhaps the most striking feature of the adult animal is the conspicuous ruff of long, soft, white hair which, partially surrounding the base of the slim neck, falls down over the chest and makes the dainty forelegs appear to project from wispy plumes of wool, giving an almost birdlike aspect. The white ruff is a sign of maturity and is lacking in lamb vicuñas, which, however, show signs of where the ruff is to appear. Moreover, lambkin vicuñas are much lighter in color—all fawn—and softer coats than theirs are hardly imaginable. They surpass in fineness and silkiness even those of their parents, a fact that was put to practical use by the ancient Peruvians, who made special fabrics from such fleeces. Alpaca hair also varies according to age, sex, and location, and some alpaca hair is actually finer than the thicker vicuña hair.

On the puna, vicuñas run in small

▲ Over the rim of these giant walls of central Peru lies the lofty domain of the little camel with the golden fleece

➤ Tending baby while she shears a hobbled ram, this Indian woman of Ayavaca, Peru, cuts the wool with a crude knife blade in exactly the same way in which her ancestors sheared wild vicuñas

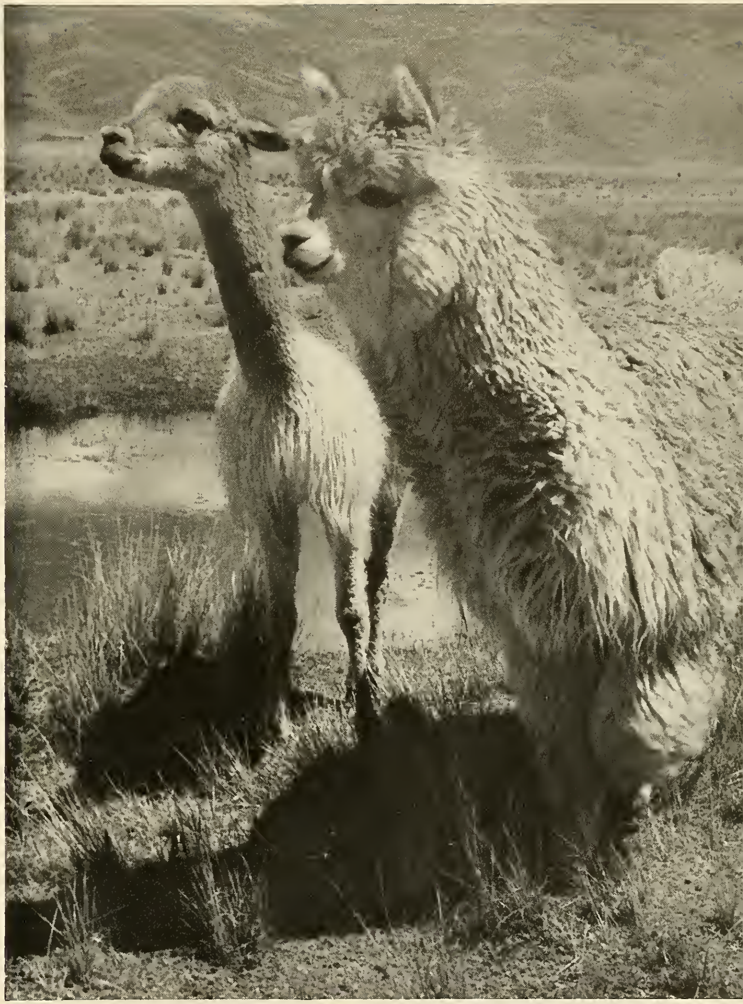
groups of from six to twelve animals. These are all females and young except for the leader, which is a vigorous male. Over a century ago, the distinguished Swiss zoologist Von Tschudi ably described the daily activity of such a vicuña family group: "Whilst the females are quietly grazing, the male stands at the distance of some paces apart and carefully keeps guard over them. At the approach of danger he gives a signal, consisting of a sort of whistling sound and a quick movement of the foot. Immediately the herd draws closely together, each animal anxiously stretching out its head in the direction of the threatening danger. They then take flight; first moving leisurely and cautiously, then quickening their pace to the utmost degree of speed; whilst the male vicuña, who covers the retreat, frequently halts to observe the movements of the enemy. The females, with singular fidelity and affection, reward the watchful care of their protector. If he is wounded or killed, they gather round him in a circle, uttering their shrill tones of lamentation, and they will suffer themselves to be captured or killed rather than desert him by pursuing their flight. The neigh of the vicuña, like that of the other animals of its class, resembles a short, sharp whistle. But when the shrill sound vibrates through the pure puna air, the practiced ear can readily distinguish the cry of the vicuña from that of the other animals of the same family."

Von Tschudi might have added that, like many wild things, vicuñas seem to have a big bump of curiosity, which undoubtedly has led

more than one to its demise. Upon the approach of anything strange, instead of running straight away, they lope off a bit and turn to observe. If no danger is apparent, they generally approach cautiously and linger for a long while. The writer, when traveling by car, has more than once come upon such a group. They seemed to consider the automobile inoffensive, in fact worthy of investigation. But as soon as a person stepped out, the group would hurry off over the horizon. Their fleetness has been their safety. This, together with the absence of firearms among the highland Indians and the stringent laws that supposedly protect them, accounts for their survival today. For certainly an animal with a golden fleece so valuable would long since have been exterminated in the centuries following the Spanish Conquest.

Ancient Conservation

Actually, the vicuña was better protected before the conquest of Peru than it is today—protected by this hemisphere's (and possibly the world's) original conservationists, the Incas. Their civilization recognized the value of vicuñas—and all other game—and enacted laws accordingly. These laws worked, too, for under the Incas anyone molesting one of these little camels, except in one of the orderly state-run hunts, was subject to death. One might say that the vicuña was a royal animal. Dainty vicuña figurines were wrought in gold, silver, and stone; and vicuña fleece was woven into fabrics reserved only for the nobility.

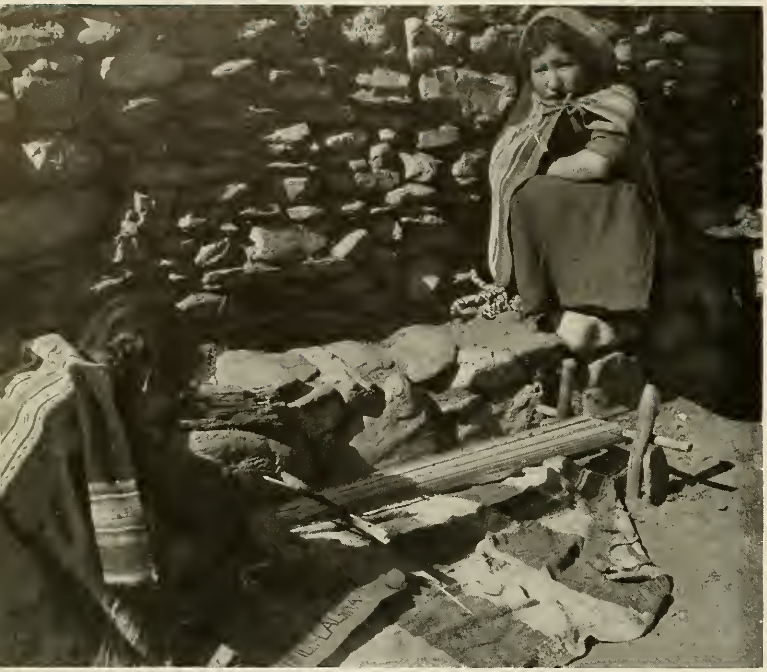


▲ Compared to the poodle-like alpaca (*right*), an adult vicuña is a dainty, deerlike creature. However, its depressed ears are a warning that a wad of spittal is about to be sent in someone's direction

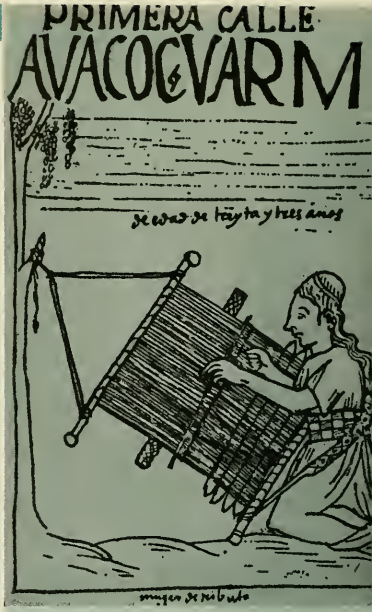
Vicuña fabric of any sort was called *cumpi* by the Incas. Much of it was woven by men, the so-called *cumpi-camayoc-cuna,* on curious upright looms that have long since disappeared. Certain types of *cumpi* were better than others, that from lambkin vicuña surpassing that from adult fleece. The finest *cumpi* was woven by the chosen women (*acllacuna*) or Virgins of the Sun, the Incas' handwomen. It is even said that they improved it with the even silkier hair from bats, of all things. But little credence can be placed in this story, because the longest fur from any Peruvian bat is only 7 or 8 mm. in length, and spinning such a short staple by hand would be impossible.

Vicuña wool, in preparation for thread making, was washed in water but never thoroughly. The natural animal oils were valued, in combination with the spinner's saliva applied by the thumb and forefinger, to produce a woolen thread that was remarkably pliable and smooth. The ancient process of thread making has been handed down to the modern Indians, and wherever one sees them, even when they are backpacking burdens or children, one may spot the ever-present distaff and whirling spindle.

From the hands of the chosen women of ancient Peru have come some of the finest wool textiles ever made anywhere in the whole world. Before Europeans reached South America, thread was being spun and woven by Andean Indians into tapestries so fine as to show a weft count of 350 weft threads to the



▲ **A WOOL BELT being woven by Indian girls of Sandia, Peru. This is a variant of the backstrap loom, in which tension is varied by leaning back on a strap around the weaver's waist**



▲ **A BACKSTRAP LOOM of a type sti
used in Peru today. On such loom
fabrics of almost all types can be mad
if the weaver has skill and patience**

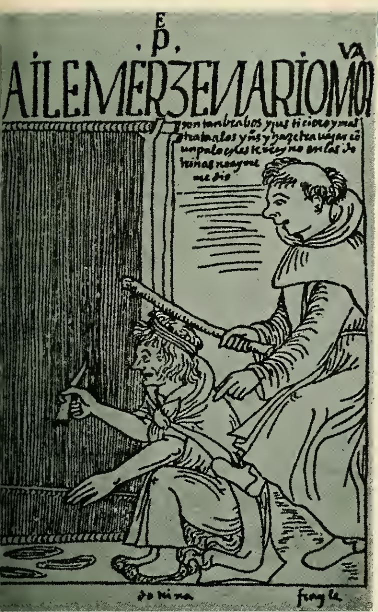
inch. Yet the best that modern man has been able to produce from fine vicuña wool is a weft count of 90! The rarity of true vicuña weavings is shown by the fact that, although there is no doubt of their existence in ancient times, we know of no unquestionable example among the collections in museums. Many pieces have not been subjected to the specialized microscopic analysis that is necessary to ascertain the identity of vicuña hair, but the ones that have, have proved to be alpaca. Unfortunate it is that such a luxury art as that of *cumpi* weaving was suppressed by the Spaniards and its technique of manufacture lost through the centuries, perhaps forever.

In Inca times vicuña wool was obtained systematically during one of the great public hunts called *cako* or *chacu*, sporting events that were held periodically and served not only to reduce the surplus game but also to increase the meat supply. We have an authentic account of one of these imperial hunts, for one was organized in honor of Pizarro by Manco Inca. In this particular hunt more than 10,000 Indian beaters surrounded an area approximately 50 miles in circumference. Closing in gradually, they drove all encircled animals into a common center, and when the human net was tight enough and small enough, designated hunters entered to kill the animals required. Of the animals thus trapped, only the vicuñas were ordinarily taken alive and shorn, presumably being hog-tied during the process. Simple bronze or copper knives, the only metal tools available, were probably used in the shearing. And even today a simple knife is the shearing implement of the highland Indian in vicuñaland.

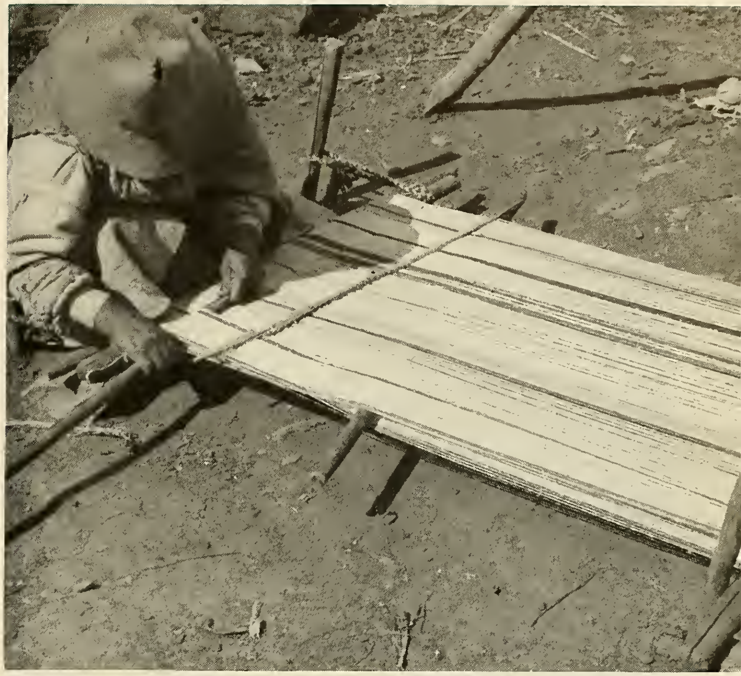
Did the Incas attempt the domestication of this beast with the golden fleece? As they had no written language, we can only say we do not know. But since ancient Peruvians domesticated the closely related alpaca and llama, we might guess that they tried to tame the vicuña and failed. Or, since vicuña wool was reserved for the royalty, perhaps it was better left a relative rarity to be obtained from the wild only through the medium of the public hunt.

The Threat of Extinction

With the conquest of the Incas by Europeans, all their strict and able conservation practices failed. The Conquistadores could scarcely believe that the fine vicuña textiles that fell to their plundering hands were made from a wool. Instead they thought it was some New World kind of silk. As with the other riches of Peru, greed got the best of the conquerors. No sooner had



A VERTICAL LOOM used by select men eavers for making fine tapestry cloth. his type was last used shortly after e Conquest



▲ **A WOOL PONCHO,** universal outer garment of the highlands, being woven on a loom stretched between stakes. Ponchos made of vicuña cloth are still highly prized, being noted for lightness, softness, and well-nigh impermeability to rain

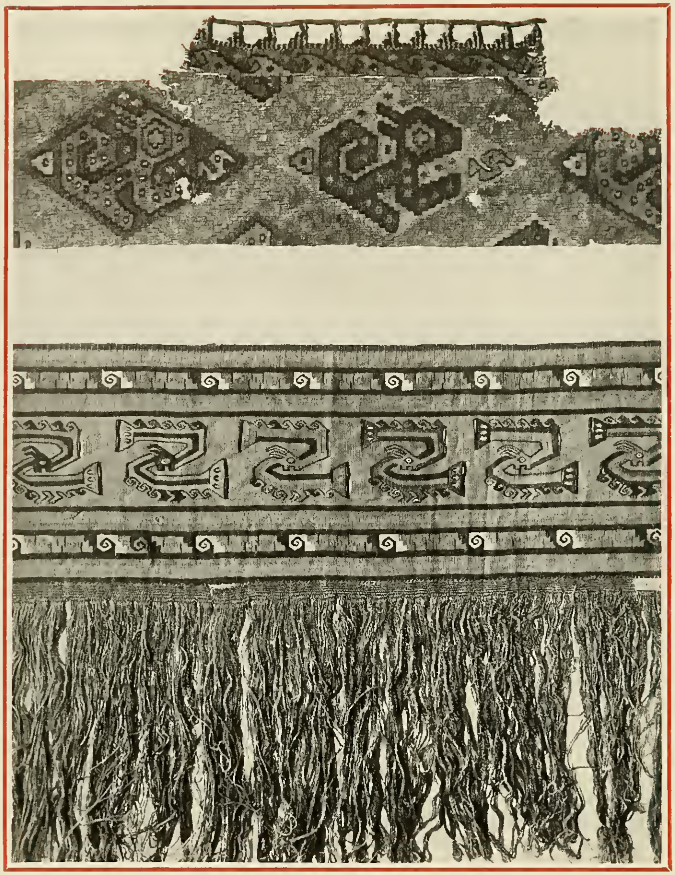
they learned of the true source of this New World "silk" than slaughter of vicuñas became wanton. The animals shortly approached the verge of extinction, if one is to believe the writers of the time. By the beginning of the nineteenth century, the time of Peruvian independence, the stock of these little camels had been so decimated that in 1825, Bolivar enacted a decree prohibiting their killing. The Liberator further offered prizes—without success—for the vicuña's domestication.

Compared with Inca times, the vicuña population was sadly depleted, but possibly it is erroneous to say it was on the verge of extinction. For there are so many isolated, uninhabited *refugia* in the high puna country, even today, that to kill all the vicuñas would seem to be next to impossible. Von Tschudi, who was certainly a careful scientific observer, noted about this time (1838-1842) that "frequent hunting seems not to have the effect of diminishing the numbers of these animals . . ." In the altos, he said, they were still found in vast numbers. The same writer took part in a variation of the old Inca hunt, which apparently is still promoted today, occasionally and furtively, by the highland Aymara Indians of the Titicaca area. Von Tschudi's description is worth quoting:

The Hunt

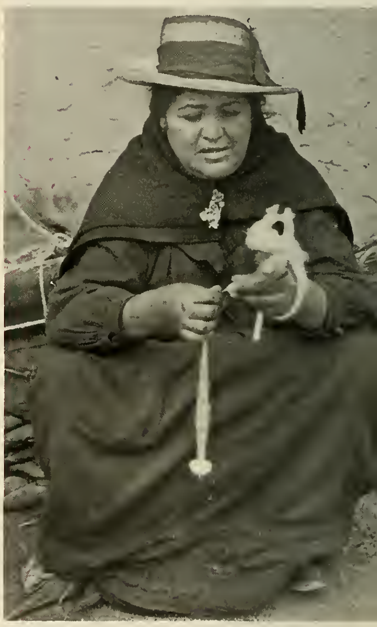
"In this curious hunt, one man at least belonging to each family in the puna villages takes a part, and women accompany the train, to officiate as cooks to the hunters. The whole company, frequently amounting to seventy or eighty individuals, proceed to the altos (the most secluded parts of the puna), which are the haunts of the vicuñas. They take with them stakes and a great quantity of rope and cord. A spacious open plain is selected, and the stakes are driven into the ground in a circle, at intervals of from twelve to fifteen feet apart, and are connected together by ropes fastened to them at the height of two or two-and-a-half feet from the ground. The circular space within the stakes is about half a league in circumference, and an opening of about two hundred paces in width is left for entrance. On the ropes by which the stakes are fastened together the women hang pieces of colored rags, which flutter about in the wind.

"The *chacu* being fully prepared, the men, some of whom are mounted on horseback, range about within a circuit of several miles, driving before them all the herds of vicuñas they meet with, and forcing them into the chacu. When a sufficient number of vicuñas is collected, the entrance is closed. The timid animals do not attempt to leap over the



◄ **Though not** a single sample of ancient vicuña weaving appears to have been identified by actual tests, this remarkable tapestry border of alpaca illustrates the exquisite weaving of the late Chimu period (A.D. 1000-1400). Colors are crimson, deep pink, yellow, black, and white, and they are woven with superb symmetry and harmony

▼ **Spinning vicuña wool** by the ancient method handed down from Inca times: a highland woman using the typical wooden distaff in her left hand and the spindle in her right



ropes, being frightened by the fluttering rags suspended from them, and, when thus secured, the Indians easily kill them by the *bolas*. These bolas consist of three balls, composed either of lead or stone; two of them heavy and the third rather lighter. They are fastened to long elastic strings, made of twisted sinews of the vicuña, and the opposite ends of the strings are all tied together. The Indian holds the lightest of the three balls in his hand, and swings the two others in a wide circle above his head; then, taking his aim at the distance of about fifteen or twenty paces, he lets go the hand-ball, upon which all the three balls whirl in a circle and twine round the object aimed at. The aim is usually taken at the hind legs of the animals, and the cords twisting around them they become firmly bound. It requires great skill and long practice to throw the bolas dexterously, especially when on horseback: a novice in the art incurs the risk of dangerously hurting either himself or his horse, by not giving the balls the proper swing, or by letting go the hand-ball too soon.

"The vicuñas, after being secured by the bolas, are killed, and the flesh is distributed in equal portions among the hunters. The skins belong to the Church." The chacu hunt described by Von Tschudi took place in the altos of Huayhuay, and during the five days of the hunt, 122 vicuñas were caught.

Laws to Protect the Vícuña

During the hundred years since Bolívar first acted to conserve the vicuña, protective laws have been sporadically reinacted by the Peruvian government. Rigid control of hunting is impossible in a country without game wardens, but these laws are certainly a step in the right direction. As recently as 1940, a decree was passed prohibiting the killing of vicuñas or the possession of any articles made from their skin or wool. That the law has its infractions may be judged from the fact that a traveler in puna territory may easily, if at times furtively, acquire articles from the natives such as vicuña-skin robes, hats made of vicuña felt, or vicuña woolens. Although obtainable, they are difficult to get out of the country except with official permits. Moreover, nearly every highland village boasts of one or more tame vicuñas, animals usually captured as lambs (when a female is killed) and then reared as pets.

Despite these minor infractions of the law, the vicuña is fortunately not uncommon today in some places, especially in the outlying fringes of the altiplano. Although listed in 1942 as a vanishing mammal of the Western Hemisphere, the present status of this little camel is hardly that. In Peru alone, estimates of the wild vicuña population run from a conservative (and more probable) fifty thousand animals to an optimistic million. These figures are little more than guesses.

Attempts at Domestication

Modern Peruvians are showing signs of accomplishing what the ancient people failed to achieve—the domestication of this beast with the golden fleece. If practical, this should bring a new and profitable industry. Several large private haciendas in Peru's state of Puno already have small experimental flocks of vicuñas for husbandry study. Most of these animals were captured by running them down on the puna with horses, a difficult job. Peru's National Board of Wool Industry is behind these studies. Even with abundant terrain for their project, problems still exist. Though easily and frequently tamed, vicuñas usually refuse to breed in captivity, thus making the building up of a commercial flock most difficult. But if given ample space, simulating wild conditions, it has been found that vicuñas may breed within a fenced area.

Sizable flocks are needed, because the little beasts produce only about a third of a pound of fine wool per adult animal. About a third of this represents the longer beard hair comprising the vicuña's outer coat—useless in fine textile manufacture. The remaining two thirds, about a quarter of a pound all told, is the silklike inner hair yielding the stock for fine vicuña fabric. Thus the annual wool production from a pioneer flock of 300 domesticated vicuñas is only 100 pounds, barely enough to make half a dozen fine coats. No wonder yardage of vicuña fabrics is valued in the hundreds of dollars!

To increase the wool production, experiments have been made in crossing the vicuña with its cousin the alpaca, the most important of South America's "camels" as far as wool production is concerned. Such hybridizing has been successful, and the hardy progeny of these crosses, known as paco-vicuñas, show the heavy wool production of alpacas with some of the finer characteristics of vicuñas. Unfortunately, the characteristics of the original cross do not hold in succeeding generations, the wool decreasing in value to such an extent that hybridizing has been given up.

Widespread vicuña domestication may still be a thing of the future, but it must eventually come. Highland Peru and Bolivia can well afford to develop a luxury industry such as this. Once the civilized world has seen the superb qualities of vicuña wool, it will surely demand fabrics originating from this prince of wool bearers, the little Andean camel with the Golden Fleece.

▲ A LOVABLE VICUÑA ORPHAN, two weeks old, being reared on cow's milk

➤ THE VICUÑA is graceful in motion and has been seen to keep up with trains of the Southern Railroad of Peru

CLOWN FISH

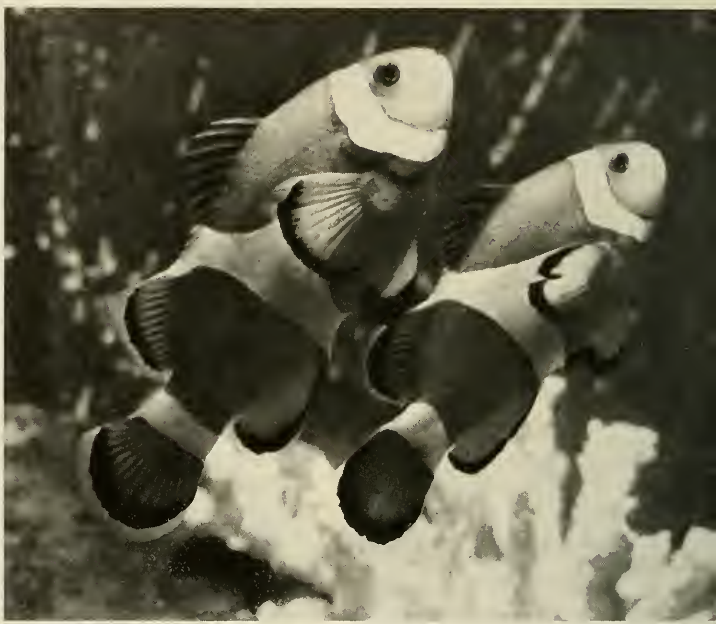
Serving as nursemaid and provider for a vicious "sea flower," this gorgeous little fish enjoys the comfort and safety of a well-armed castle

By Woody Williams

Photos by the author, courtesy Steinhart Aquarium, California Academy of Sciences, San Francisco

IT is not uncommon for an aquarist to be accused of touching up his tropical fish with a paintbrush—especially if the fish are damselfishes (Pomacentrids), such as *Amphiprion percula.* These pygmy beauties, about three inches long, are bright orange with bizarre stripes of white, and their fins are tipped with black. They come from the Indo-Australian coral reefs of the western Pacific. Because of their slow, clumsy "gait" and flamboyant color patterns they have been named "clown fish." But to the biologist they are more than comical oddities from the South Seas. As partners of the large sea anemones, they represent one of nature's most astounding examples of symbiosis—the close association of two dissimilar organisms for mutual benefit.

Symbiosis is not rare in nature, but there are few examples where the relationship seems so intimately integrated as among the damselfishes and the large sea anemones, such as *Stoichactes*, among whose tentacles they make their home.

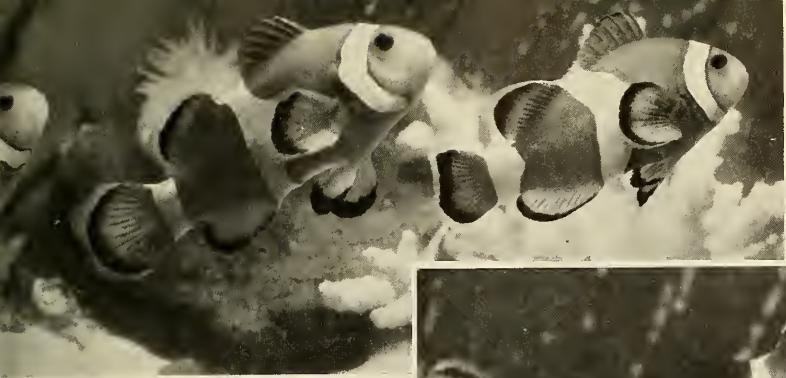


▲ Bright orange with conspicuous white stripes, the clown fish attracts much attention in the aquarium because of its beautiful appearance. But its extraordinary habits are even more startling

These petal-like tentacles, to all appearance as innocent as a daisy, actually possess the stinging power of a nest of hornets. Some of the tropical anemones are known to inflict painful wounds on man, to say nothing of their potency against lower creatures of the sea. The instrument that produces such effective results is a comparatively complicated one-celled structure called a nematocyst, present in countless numbers. These stinging cells eject a dart which, when it pierces the tissue of an unlucky visitor, injects a poison that often causes pain or death. Yet the damselfish nestles among these lethal tentacles with perfect safety. Indeed, the fish's very existence on the reef would be questionable if it were not able to seek refuge among the anemones without bodily harm. If deprived of its hiding place, it would become easy prey to larger forms, for it is a slow swimmer and its gaudy suit is conspicuous.

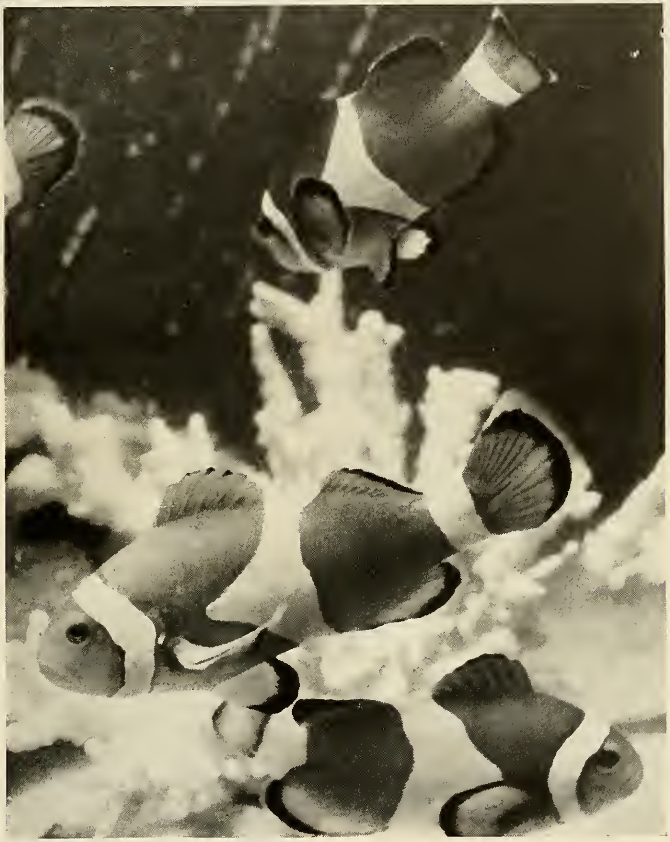
Apparently these fishes are immune to the poison of the stinging cells. But not just any anemone with an effective battery satisfies a given species of damselfish. Each kind of damselfish restricts itself to one or sometimes a few species of anemones, the choice depending probably to some extent on appropriate size. The marine biologists in Java who have studied *Amphiprion* and related forms most extensively have learned to predict which species of damselfish will be found in given types of sea anemones.

They have also found that damselfishes are primarily individualists. Once a pair of clown fish have



THE HOME of the clown fish is among the
entacles of the sea anemone, which contain
tinging cells that are often fatal to creatures
f the sea. Yet this fish nestles here in perfect
afety

▼ LIKE BEAUTY AND THE BEAST, the strange relationship between the gentle clown fish and the lethal sea anemone progresses happily—with curious benefits to both parties



established a home in an anemone (or a group of anemones), they tend to maintain the territory for themselves. However, young clown fish are sometimes found in the same anemones with adults, who perhaps did not have the persuasive power to evict the youngsters.

Some relatives of the clown fish are quite emphatic in their defense of home. This trait sometimes leads to their capture. When a diver descends near their home, they will rush out from the anemone and nip his legs, shoes, and net, thus exposing themselves to easy capture. Generally, however, the clown fish will hide in the disc of the anemone, remaining there even after the anemone is lifted from the water, and in this way they can be collected. Such a clown fish, together with its anemone, lived for years under the care of a woman in Philadelphia, according to Frederick H. Stoye, who writes on tropical aquarium fishes.

The species of *Amphiprion* shown in these photographs is believed to pair off for life. The female outdoes the male in size, and following a tendency that some think they detect in human society, she is the aggressive suitor. Nipping each other's flanks is one of the favorite courtship pastimes. The male cleans off a hard surface at the base of the anemone, and the female deposits 200 or 300 eggs. The housekeeping is done by the male. After the eggs have been laid, he rubs against the tentacles of the anemone, directing them downward so that they camouflage the eggs. This ability of the clown fish to direct the actions of the anemone is one of the most remarkable aspects of their relationship.

Many details in the later development of the young *Amphiprion* are still concealed in the mystery of reef life. However, the Netherlands scientists are quite certain that after hatching, the young swim to the surface and feed on tiny floating or weakly swimming animals. Many *Amphiprion,* in turn, are of course preyed upon by larger creatures in this combination nursery and hunting ground at the surface of the sea.

In a short time, the survivors of this vertical migration drop again to the bottom and search out anemones in which to set up housekeeping. If the anemones are scarce, several clown fish may congregate in one.

For a time, the clown fish feeds on minute bits of life captured by the tentacles of the sea anemone. But as it matures, it probably again depends primarily on floating organisms passing near its home. In captivity, *Amphiprion* appears to do well on *Artemia,* otherwise known as brine shrimp, which are collected from highly salty waters or hatched out from eggs in salt solutions in the laboratory or home. In nature, the clown fish's feeding habits are not well known

One species of damselfish is known to carry morsels of food to its anemone and place them among the tentacles. Even more astonishing is the report that a damselfish has been seen to "nurse" a sick anemone back to health by fanning it and rubbing against it, a situation that is said to occur when the sea water becomes unfavorable to the anemone's health. The anemones seem definitely to do better when accompanied by their damselfish. On the other hand, damselfish have occasionally been observed to feed on the tentacles of the anemone that shelters them, and it has been suggested that this habit builds up an immunity to the poison.

Such, in brief, is the strange partnership between these two fascinating animals that dwell together on the bottom of the sea. The average man, lacking the elaborate equipment used by the undersea explorer, can nevertheless observe their strange behavior in some of our public aquaria. One cannot fail to imagine what fascination they would hold as household pets in the home fish tank. But these are creatures of the sea, not of fresh water. Last year, two shipments of *Amphiprion* came into the United States through San Francisco, but the great losses that were suffered in transit across the Pacific caused further efforts toward importation to be dropped. So the best thing one can do is to ask whether he can see the clown fish and its strange partner the next time he visits a large city aquarium.

Anyone wishing to learn more of this strange partnership will be repaid by reading Dr. E. W. Gudger's comprehensive paper in the *Journal of the Royal Asiatic Society of Bengal* (Science), Vol. XII, 1946, No. 2.

Animals of the

High among the rock-strewn slopes, four furry alpine animals will soon emerge from their snow-bound castles to enjoy a brief season of sunshine — spring, summer, and fall crowded into one

By Tom McHugh

All photographs by the author

THE CONY, OR PIKA, makes hay while the
shines and then luxuriates beneath the
w. Photographed in early July, this seven-
h animal shows only one remnant of its
vy winter coat—the light patch on its hind
rters

➤ UNDER as much as ten feet of snow, the higher slopes of the Rockies are slow to welcome summer. Protected by this blanket, the mountaineering mammals either hibernate or subsist on stored food

Avalanche

A SHORT alpine shower had temporarily slowed our pack trip on its way over a mountain pass in the Rockies. Brief yet violent, this storm spent its force in less than an hour. Clearing skies again brought quiet to the high country—but not for long . . .

Soon we were startled by a sound that began like the roar of distant thunder. Rapidly becoming louder, the din threw the area around us into turmoil. Our horses reared up in fright. Small animals scurried for shelter. At that moment we witnessed the greatest spectacle in the struggle between weather and the mountains:

Avalanche!

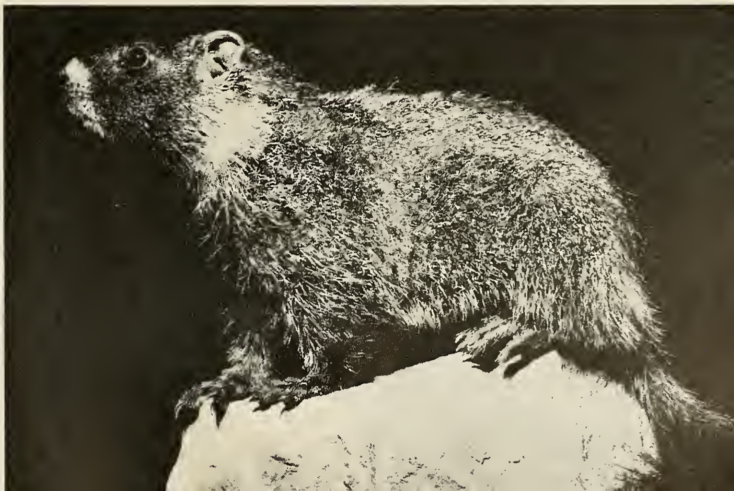
Rock jarred by the recent storm had just toppled from a high crag to start a cascade of boulders, which gathered more force by the second. This river of rolling rock poured destruction down the mountainside next to us. Like the spray from a waterfall, a cloud of stone powder rose from the grinding landslide. Small clumps of trees were snapped like matchsticks. This thunderbolt of boulders finally stopped when it hit more level ground on the valley floor below.

Then only the burned smell from the grating rocks called to mind the ruin on the slope before us. It was a picture of confusion—confusion in the tangled mass of rock and confusion in the fact that this avalanche had actually been a godsend to a group of alpine animals. Oddly enough, the rockslide had made more homes for these creatures.

Such piles of rocks or talus, as they are called by geologists, form a very secure fortress for four ingenious creatures: the pika, the marmot, the golden-mantled ground squirrel, and the bushy-tailed wood rat or pack rat. Using rock piles as secure homes, these mountaineering mammals can survive the rugged alpine life on our western snow-capped ranges.

A quick glance at the talus slopes leaves an impression of bleak desolation. "How could anything possibly live on that barren desert of rocks?" asked my companion. But he failed to look closely. Here and there in bits of soil among the boulders small plants can eke out an existence. With tiny leaves and stems, they devote most of their energy to large colorful flowers. Greenery growing in the lush mountain meadows next to the rockslides fares better, for it is usually fed

➤ A MARMOT, alert for danger atop a lookout post. Should enemies approach, he will quickly sound his alarm, and all marmots roundabout will dive into their rock castles



IN ROCKSLIDES like this one, the marmot,
a, wood rat, and golden-mantled ground
uirrel make their homes. You can find them
en as high as the snow fields on the distant
ak

from the water of countless melting snow fields.

Higher up, near timber line, the picture does become more desolate, however. Trees that are about 100 years old grow no more than waist high. They are stunted by the short growing season, the strong dry winds, and the low temperatures. As we climbed above the last remnants of these trees, other plants also became scarce. In their place, ice filled the cracks between the rocks. We were forced to wear gloves even during midday, the rocks were so cold. And the brisk alpine breeze didn't help matters. "I guess we've seen the last of any animal life," I was finally forced to remark to my friend.

But I was wrong.

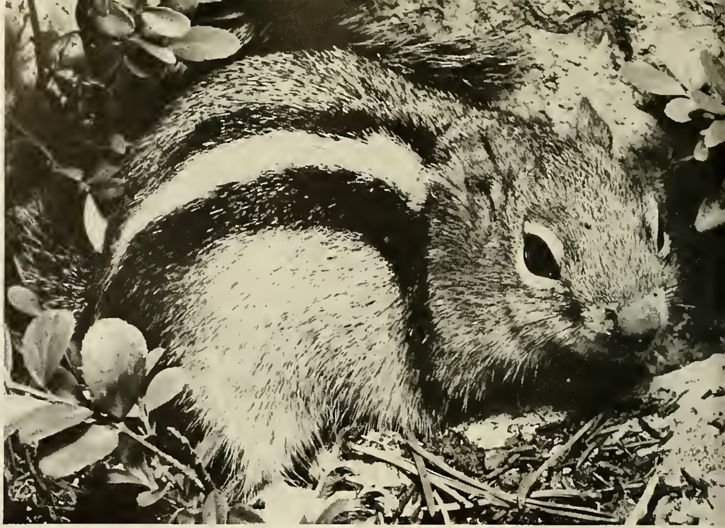
As we struggled to the peak of the Grand Teton, we found tracks. Running across a large snowbank at an altitude of over 13,000 feet, they showed where a pika, or cony, had wended its way in search of food. Conies have been found even higher than this. They occur up to an elevation of 14,254 feet in the Sierra Nevada range – almost 3 miles above sea level!

Lower down, around timber line, these alpine animals make their best stand. Although their talus slopes appear bare and abandoned at first, the occupants quickly let you know that someone is home. As an intruder and potential enemy, you are greeted by a chorus of sounds. These alarm notes are the telegraph system of the rockslides.

The most unusual call sounds like "*enh*" and seems to say "*Yeah?* Mind your own business!" It has what speech teachers would call a "nasal twang." But more than anything else, it is confusing because it is difficult to localize. The sound seems to come from nowhere on the talus slide, until finally the originator moves about and reveals himself to be a pika. His head points skyward like a baying wolf, his feet shuffle, his ears twitch upward, and his shoulders move forward as if to expel more air from his lungs—and out comes another "*enh*"!

The pika's call alerts the marmots, or rock-chucks, who burst forth with a volley of sharp whistles. The whistles don't seem to be alarm notes at all. Rather, they express doubt or inquiry. Other marmots in the vicinity climb to vantage points on the rocks to see what's happening. Then, if danger really threatens, the sentinels sound the alarm call, a coughed "*keyuck.*" This immediately sends all marmots to the depths of their rock castles.

The golden-mantled ground squirrels also have a language all their own, even though it isn't as obvious. Chittering buzzes, grunts, and rasping notes convey their feelings, especially during fights. Danger brings forth explosive alarm notes that sound like a whistled chirp. "*Tsp,*" they proclaim, and their whole body reflects concern with a nervous tail-twitch. Other squirrels in the area hear the call and come to attention, standing up on their hind feet and clasping their front paws together. It is the very picture of a minister in the pulpit ready to give a sermon.



▲ THE GOLDEN-MANTLED GROUND SQUIRREL is the most colorful of these alpine animals. The bright rufous color of the head thins out down the back but appears again in the tail

▼ THE WEASEL—probably a more serious enemy than the foxes, wolves, bobcats, and other larger creatures that prey on the little animals of the avalanche

Even though wood rats come out only at night, they also have a telegraph system. When danger draws near, a hind foot or the end of their tail rapidly vibrates on the ground. As the first rat thumps out an alarm signal, other rats within thumping distance pick up the message and relay it to still others within hearing. All animals are then on the alert to escape if enemies should come their way.

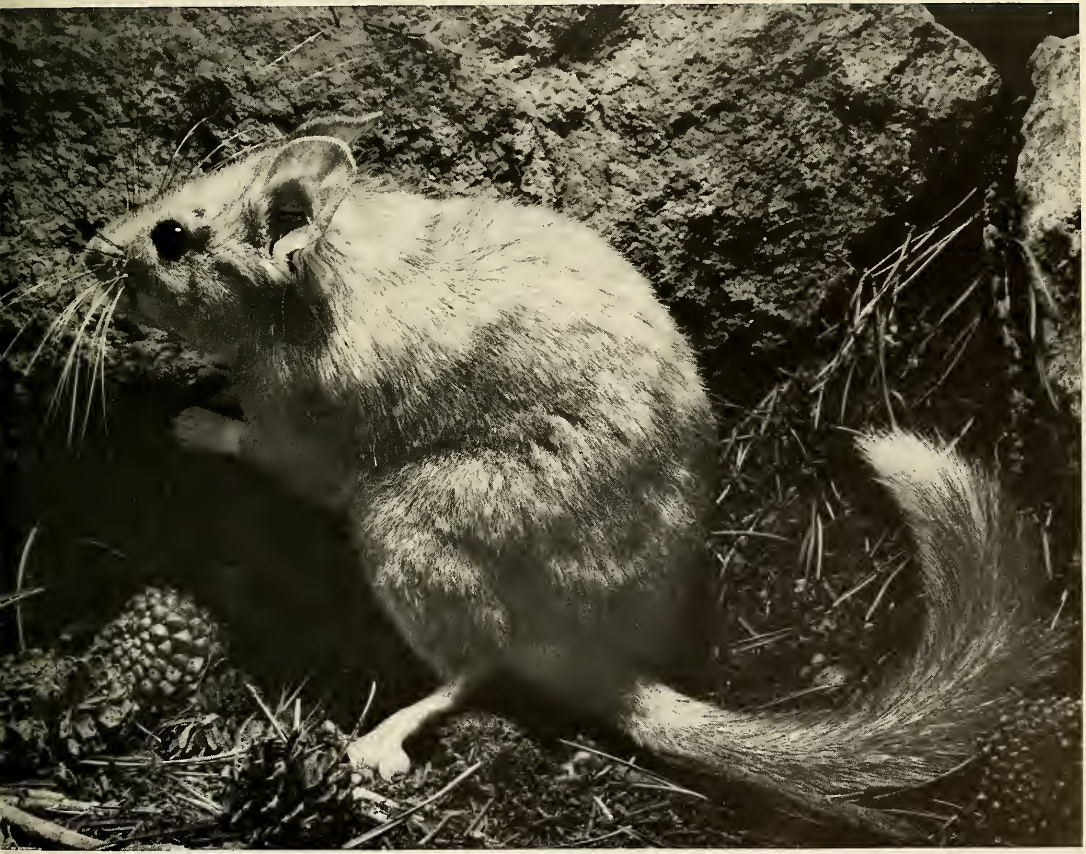
Wood rats also leave messages in another unusual way. A special gland below the tail produces a strong musky scent, and wherever the rats go, they may leave a bit of this odor to mark the place. It may serve to label the territory of one rat and warn other individuals to keep off, and it may also help indicate trails so that they may be easily followed on dark nights.

Different as are the ways of life of these four mountaineering mammals, and different as are their alarm calls, these creatures are still one family. They may depend on each other to give an alarm note. More than that, though, they are one family because they all live in the most secure home in the mountains, the grottoes of the talus slides. And they realize the protection given by their rock castles.

Although conies will travel some distance among the rocks for food, they seldom venture far beyond these rock boundaries. When not busy finding food, they like to sit

▲ AN ENEMY of the denizens of the rockslides: a young red fox whose mother had just killed a marmot

▼ WITH HIS BIG EARS, fluffy fur, and bushy tail, the wood rat is a captivating member of the alpine quartet and need never be confused with the house rat. It has been known to collect almost everything from mousetraps to false teeth



on some prominent boulder where they have a wide view of the whole slope. This is the crow's-nest of their rock fortress. When a golden eagle —or some other enemy "plane"—circles near, their air raid sirens go into action. A series of rapidly repeated "*enh's*" broadcasts the warning, and then they tumble back into the rocks—a veritable bomb shelter.

Conies live all over the rockslides, but marmots prefer to build their den in a group of rocks near more vegetation. Here they cleverly locate their burrow between two boulders so that there is just enough room for a marmot to pass through. The tunnel is small enough to keep out larger enemies like wolves and coyotes.

While one marmot keeps a lookout on top of the rock pile, others from the den bound along like little pigs into the mountain meadows. Well-marked trails lead from the rocks to the feeding grounds in the flowered fields. If the distance is several hundred feet, a temporary burrow may be placed at the halfway point. This will serve for momentary protection until the danger is gone or until they can make a rush for the home den.

Golden-mantled ground squirrels, or "callos" as they are called for short, make their homes under the rocks near the bordering woods. They shun the deep shade of dense forests, however. Home is a little hole in the ground two or more inches in diameter and under the rocks.

There the young are born in spring or early summer. Once large enough, they emerge and romp in the sun near the burrow. When danger threatens, their mother rushes back and pushes them down into the hole with her forepaws, but innocent of the enemies in the upperworld, they rapidly pop out again when mother goes away. When bothered by too many people, I have seen a much disturbed mother pick up the young in her teeth and move them to a safer burrow.

The bushy-tailed wood rat builds his home in crevices in the rocks or in near-by cabins. The home provides protection and serves as a nursery and as a storage place for food. Above all, however, it is a "museum," for the wood rat is an industrious curio collector. Nothing escapes his eye as he packs in bric-a-brac for his nest, which may grow to include several bushels of junk.

Nests have contained such things as old shotgun shells, mousetraps, washbasins, silk socks, bright neckties, candles, soap, dynamite sticks, hen's eggs, and a clipping on forest-fire prevention. One nest contained a bushel of trash, all of which was metal. There was even an alarm clock in the pile.

People who have camped near pack rats in the mountains have had many articles of food disappear each night. Sometimes several rats participate in a raid so that larger items can be hauled off. For example, several rats banded together to roll, push, and drag a large jelly roll out of one tent.

It is hard to say how many fine friendships have been broken by pack rats. One inexperienced camper placed his false teeth beside his sleeping bag when he turned in for the night. When the teeth were gone the next morning, he blamed the guide and gave a heated lecture about practical jokes. The lecture subsided, however, when the guide located the missing teeth amid the loot in a pack-rat nest. The activities of wood rats produced even tenser moments in pioneer days. Cartridges disappeared very mysteriously in dangerous country, leading to no end of dark suspicions and perhaps even tragedy.

Sometimes the rats develop a streak of mischief that might be humorous if they were not so persistent. One little beast continually centered his efforts on the wood-box in an old shack. Each night he would drag the wood out onto the floor and place the pieces in neat rows. This was repeated many times.

Wood rats are also known as trade rats because of their habit of stealing something and then leaving a stick or other worthless object in its place. Many old-timers used to think this trait quite clever and cunning. They thought the pack rat had two reasons for trading: the theft would very likely go undiscovered if the rat substituted another piece of junk; and besides, it showed that trade rats were basically very honest, since they exchanged rather than stole articles.

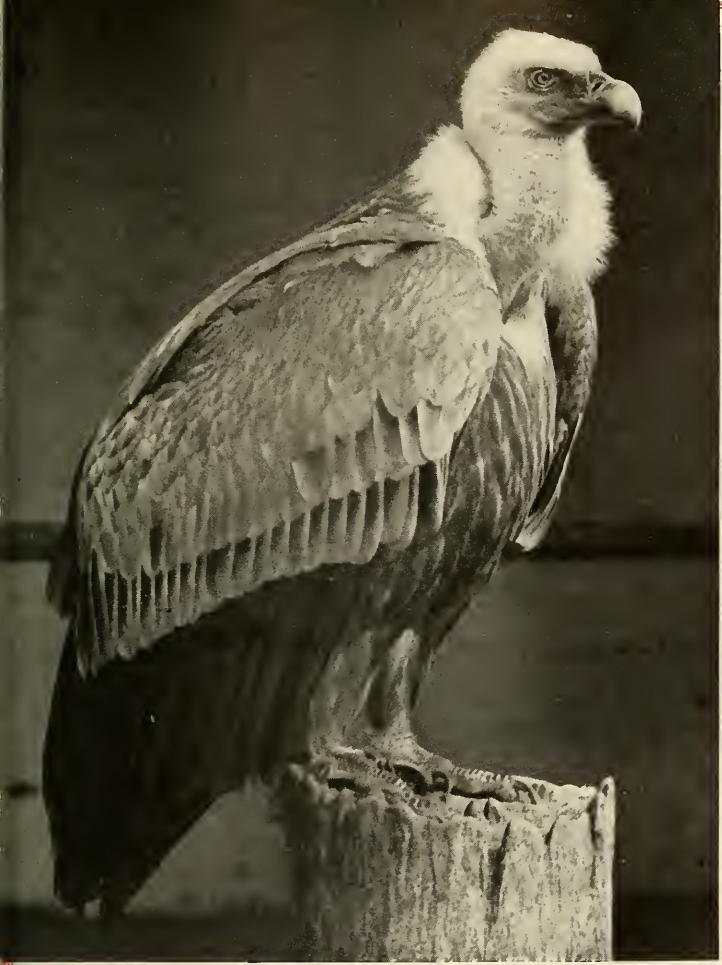
All this, of course, is sheer foolishness. The pack rat is often carrying a bit of trash for his pile when he chances across an object of even greater esteem. In his greed, he merely drops the first object and picks up the new item. Thus the "trading" habit.

With a home deep in the rock fortress, wood rat, pika, marmot, and callo are safe from most enemies. But some of these mountaineering mammals still fall prey to bobcats, foxes, coyotes, wolves, weasels, martens, hawks, owls, and eagles. The young are especially vulnerable when they innocently wander from the protection of the rocks.

Although wolves or coyotes cannot fit into the average marmot den, they still may catch a marmot out in the open meadows. Sometimes they stealthily stalk their prey and then suddenly pounce and seize it in a strangling jawhold.

Many weasels live in the rockslides and are probably the most important enemy of the pika. Although they can thread through the thin passages between the rocks as fast as the conies, they are sometimes outwitted. As soon as a weasel enters pikaland he is greeted with a barrage of alarm calls; and when he starts pursuit of a choice bit of food, he is indeed in for a race. He dodges in and out among the rocks with unbelievable speed and follows the winding course of the cony with ease and accuracy. The safety of the pika depends on its ability to dodge and outwit the enemy, but the pika soon begins to tire. As the gap between cony and weasel narrows dangerously, another fresh and rested pika leaves its lookout station and cuts into the race ahead of the weasel and just behind the first contestant, who quickly dodges out of the race. When this trick is repeated two or even three times, the weasel shows marked signs of fatigue and gives up the unequal contest.

Continued on page 240



A study
in
feather arrangement

The Griffon Vulture

By James P. Chapin

Research Associate in African Ornithology,
American Museum of Natural History

THE Griffon Vulture (*Gyps fulvus*) is a great soaring bird of the Mediterranean Basin and eastward to central Asia. Because its meals (carrion) must necessarily be few and irregular, it is most economical of energy. Its wings are a model of efficiency. This excellent photograph by John Marinus of Antwerp, Belgium, might be called a lesson in pterylography, the scientific delimitation of feather-producing areas on a bird's skin. You will notice that the black secondaries (the quills of the forearm) are shown in a long regular row at the bottom, where they hide the primaries (the quills of the hand). Next comes the long row of greater secondary coverts. Above them is the row of middle coverts, and above that the great area of lesser coverts, in many rows. Above the wing can be seen the long scapular tract.

A wing like the griffon vulture's is a marvel of aeronautic construction, another of the innumerable examples of natural design to be seen everywhere about us. Anyone who studies birds must be impressed by the way in which almost every feather of any size is of a special shape and structure to serve a definite purpose at its particular location.

One striking feature of the whole plumage of almost every flying bird is the streamlining. Most birds are streamlined right up to the beak. The vultures, however, are exceptional in regard to the head and neck, and the reason is readily seen. If their heads and necks were well feathered like those of their near relatives the eagles, they would have much more difficulty getting their beaks and heads through openings in the tough skin of large, dead mammals to tear out the flesh and viscera on which they feed. The feathering is reduced to a downy cover that permits far greater efficiency in feeding.

A vulture may be called disgusting, but at times it is also majestic. It has its definite place in the economy of nature and usually receives equal protection by law with the songbirds. It is endowed with keen eyesight, most efficient wings, low fuel consumption, and retractable landing gear. It is a worthy member of nature's Department of Sanitation.

The gripping story of how a band of scientific explorers forced the Flaming Terror of the Andes to yield its secrets

The First Ascen

PART I

By ROBERT THOMAS MOORE
Associate in Vertebrate Zoology
California Institute of Technology

All photographs by the Moore Expedition

WHEN Edward Whymper in 1880 paused in his descent from the first conquest of Mt. Chimborazo, the giant of the Ecuadorian Andes, he caught sight of a formidable volcano 50 miles to the southeast. The blasé conqueror of the Matterhorn was amazed at the outburst taking place before his eyes. He made drawings of the eruptions, which he presumed were "outrushes of steam," and calculated their velocity to be "twenty-two miles per minute!" Whymper undoubtedly witnessed the early stages of a major eruption, which takes place at periodic intervals ranging from five to fifty years. A decade later, when writing his great classic, *Travels Amongst the Great Andes of the Equator,* he expressed astonishment that a volcano so formidable should be known to Ecuadorians "only by name." Whymper did not seem to know that 34 years earlier Villavicencio had called El Sangay the "most frightful volcano in the World." Nor did his book reveal acquaintance with the observations of non-Ecuadorian scientists and explorers who, for two centuries, had borne testimony to its devastating power.

The first written account of El Sangay is a partially burned document dated November 3, 1628, recently discovered in Ecuador.[1] It describes an eruption of about one month earlier, when the mountain is said to have "burst asunder," "terrorizing" the city of Riobamba 30 miles away and so covering it with ash that its cattle were dying and its inhabitants in dire danger of being destroyed. The next historic reference seems to be that of 1739, when Monsieur de la Condamine witnessed from the paramo of Zula a violent eruption that seemed "to set on fire the whole mountain and its crater," while a "burning river of sulphur and bitumen took its course in the midst of the snowy slopes." An amazing testimony to its energy was given by the geologist Reiss, when he stated that for four years without intermission a stream of incandescent lava flowed from the western shoulder of the

▼ WHEN CLIMBING out of the tropics, the zoologists leave large trees like these behind at the 10,000-foot level when yet 25 miles from the devastating volcanic cone. Temperate-zone vegetation in the high Valley of Alao, Ecuador

▲ INDIAN PORTERS wending their wa upward with the expedition's cargo i the Valley of the Rio Alao

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[1] See "El Sangay, Fire-breathing Giant of the Andes" by G. Edward Lewis, *National Geographic* Magazine, January 1950, p. 133, which gives an account of the last unsuccessful attempt to reach the summit.

▲ Just behind this black wall of lava the Labyrinth begins. Huge ash canyons, 500 to 2000 feet deep, extend for 15 miles from here to the base of the volcano

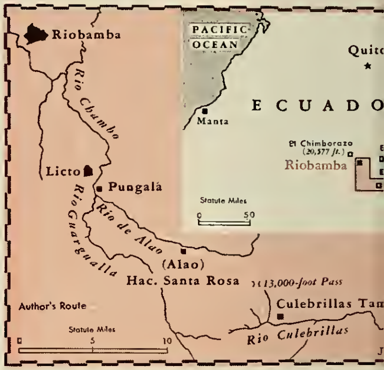
# of El Sangay

▲ "The Shroud parted for a moment, and there, 70 degrees east of south, El Sangay towered above the labyrinth of canyons." The peak is still many miles away, and a network of huge gorges lies between. To save time, the expedition ascended a 14,000-foot mountain range to the right to reach a knife-edge ridge before plunging into the Labyrinth

volcano. In 1849, the engineer Wisse expressed astonishment mathematically by counting 267 loud explosions in an hour.

Many observers have noted that the roarings of the volcano have been heard in Guayaquil, 110 miles across the Andes, and sea captains far out on the Pacific have seen the decks of their vessels drifted with its ashes. So great is the mass ejected, Reclus assures us, that it would equal that of several mountains. "It seems probable," adds Dr. A. H. Mozans, "that the disastrous earthquake which destroyed the old city of Riobamba in 1797 had its origin in El Sangay. So complete and sudden was this visitation that few of the twenty thousand inhabitants were able to escape." And then come the fables and legends that always cling to the skirts of terrifying phenomena. "Everyone

◀ Near Tres Aguas. Here, among the overhanging grasses of the riverbank, the expedition discovered the first known nests of the Black-throated Bronze-tailed Hummingbird. Like all of the more than 600 other species and subspecies of hummingbirds, it lays two pure white eggs. Tracks of the rare Mountain Tapir marked the muddy approaches to the stream



had heard of the 'Flaming Terror to the east of the Andes,'" said Commander Dyott, "but no one had ever ventured near it. Within several leagues of its base (so ran the tale) were lakes whose water spouted high in the air, drenching the country for miles around and forming a sort of water barrage." And even the renowned Humboldt did not dissolve this atmosphere of superstition by describing a fish, "*Pimelodus cyclopum*," which he says was thrown out in great numbers during minor eruptions of Cotopaxi, Tungurahua, and Sangay!

I have not space to quote from Wolf, Stübel, Hans Meyer, Stevenson, and many others who have observed the demonstrations of El Sangay. A final quotation from the *El Telegrafo* of Guayaquil will suffice: "Alfonso Stübel . . . initiated an attempt to creep up on the shoulders of the colossus in April of 1872, but he, like G. M. Dyott, the intrepid Andean explorer, abandoned the enterprise, their audacity punished by the imminence of destruction."

There seems to be no record that anyone actually crossed the snow line until November, 1925, when Commander Dyott, after months of effort, came to grips with the ice field.[2] On his first attempt he was struck down with snow blindness, and on his second he fell into a crevasse on the southern shoulder, while his companion was incapacitated by mountain sickness. Both finally abandoned the effort. *El Telegrafo* concludes, "El Sangay continued to guard its mystery inviolate—a mystery vast and sublime!"

As I survey this strange admixture of science and superstition, I do not wonder why so many efforts have been abandoned at the far-flung boundaries of El Sangay's demesne. I confess I was affected. No doubt it influenced my statement to members of the party, "This first attempt is purely a zoological reconnaissance to Culebrillas Valley, only three days' journey! There is not one chance in fifty I shall give permission for an assault on El Sangay." And yet I did!

Mysterious as it all seemed, one thing was clear—the terrain would prove a difficult problem. Detached from the main chain of the eastern Andes, El Sangay juts out over the Amazon basin, a lonely sentinel nearly 18,000 feet in altitude. Although only 125 miles south of the equator, its last half mile of altitude is crowned with ice. At its eastern base begins the tropical forest which stretches without break 3000 miles to the Atlantic. So impenetrable are the jungles of the steep eastern slope that no one has attacked the summit from this direction. On the other three sides, 1000 square miles of volcanic ash have been sculptured by almost constant rains into a labyrinth of black canyons 500 to 2000 feet deep. Down each one swirls an angry torrent—the whole constituting a veritable maze, whose intricacies have never been deeply penetrated by the superstitious Indians living about its margins. They never cross its borders save for an occasional forage among the rare animals, which here have made their last stand in a sanctuary created by superstition. Above and about it all hangs a shroud of mist and cloud, lifted but for brief intervals.

In addition to difficult terrain, severe weather conditions, and the possibility of a major eruption, the superstitious fears of the native cargo bearers constitute an even more serious impediment to would-be conquerors of El Sangay. Favored by no trails to slip through the tough undergrowth and surmount the great ranges, one must rely upon these natives to carry most of the supplies and equipment required for a month's struggle with unexplored regions. They believe that a frightful god lurks in the crater, who waits for them to enter the canyons and drowns them with floods of water and ice. Terrified by the frequent earth-vibrations emanating from the great volcano, they are ready to forsake the explorer the moment the peak appears through a rift of the shroud. Three times our party was abandoned by different groups or individuals, the mass desertion at Tres Aguas threatening disaster. With tents leaking, ammunition and food supplies wet, and fires refusing to catch flame, the party was in real danger, either of being washed out by rains or weakened by lack of food. Fortunate kills of deer and tapir relieved the tension.

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[2] See "The Volcanoes of Ecuador" by G. M. Dyott, *National Geographic* Magazine, Jan., 1929; also his book *On the Trail of the Unknown.*

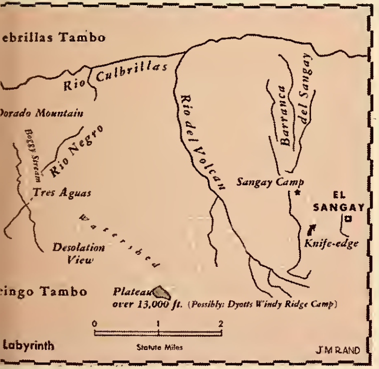
On July 15, the party, consisting of Lewis Thorne of Yale University, my son Terris Moore[3] of Williams College, Waddell Austin of the University of California, and three Quechua zoological collectors, with myself as leader, motored out of Riobamba, Ecuador. We soon found ourselves in a public square of the Indian village of Licto. Here our genial host, Señor Alphonse Merino, on whose courtesies and thoughtfulness the success of our enterprise largely depended, introduced us to our caravan of eight horses and ten pack mules. After the usual delay (according to approved Ecuadorian style), we mounted and shot through space like arrows loosed from a bow, and for three hours we careened along the Rio Alao at the same mad pace, whether the course clung to the brink of gorges, or dropped down descents strewn with boulders, or slipped through cascades loosed from the mountain above.

At Hacienda Santa Rosa, which we called "Alao" after the river, Señor Merino had a surprise for us. Through the motley mass of peons in the courtyard we were escorted into a bedroom furnished in the style of Louis XV! The leader of the party was only too glad to accept the offer of the gilded bed, for he had risen that morning with a temperature of 103 degrees. The rest of the party were shown the premises. Señor Merino explained his plans for gardens and fountains to be modeled after a famous French chateau. Electric fixtures and water pipes had been installed, although not yet functioning, and a library revealed interesting titles in Spanish and English. The buildings were the center of a ranch whose borders stretched in a vague way from the ice fields of El Altar to the affluents of the Amazon. Over this vast demesne our host reigned, a medieval lord with a retinue of peons at command. They could not leave his property without consent. His approval was asked for marriages, and punishments for misdeeds were assessed by him as judge. He had the right to use the lash.

Somewhere in this realm rose El Sangay, but the owner had never seen it, and his brother Miguel, who had, was now dead. Yes, he knew of Señor Dyott's attempt to reach the summit. Two of the peons who had gone part way with him were left; one of them—Vinci—would be our guide. "But," he added emphatically, "this is a bad time of the year to try El Sangay—the very worst! It rains every day for months! The Indians fear the rising streams!"

Nevertheless, the following morning our equipment of tents and blankets, guns and traps, cameras, color plates and films, and all the paraphernalia for mountain ascents (ice tent and optimus stove—even snowshoes and an ice ax) were packed on the backs of eleven Indians, and off they dog-trotted up the valley. Flowers were grouped in great clumps along the stream that leaped from rock to rock. Calceolarias proffered clusters of golden slippers, Taxcus climbed here and there through the thick growth, their great pink trumpets nodding overhead. Large patches of the orange parasite called "Picapus" brought beauty to the treetops and lured the Sunbeams—hummingbirds, *Aglaeactis cupripennis cupripennis* Bourcier, with a veritable sunset on their backs. But the glory of the valley was the fuchsia. The superb scarlet bells hung in every conceivable line of grace and tempted hummingbirds of many species to explore their chalices. On all this loveliness of flower and dashing water, a tropical sun shone with a balmy intensity found only in favored Andean valleys.

But beauty and sunlight had to be



➤ ON THE EDGE of a 2000-foot cliff, the newly recruited Indians are transporting the expedition along the knife-edge between Tres Aguas and Carniceria. The knife-edge has begun to widen out, and the Indians are gazing into the vast maze of ash canyons, only a small portion of which can be seen here

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[3] Subsequently Terris Moore made the first ascents of Mt. Bona and Mt. Fairweather in Alaska and still later of the 24,900-foot Minya Konka of western China.

◄ THE MARGIN of the plateau called Carniceria ("Meat Market") by the Indians. The paja grass, with rapier-like edges, grew five to eight feet tall in the center of the plateau. Herran's Thorn-bill flitted among the flowers of the pear-like tree—its fiery throat a fit symbol of the mighty volcano

left behind when we began the steep ascent of the southern rim of the valley. For a while sunlit glimpses of Alao could be caught through heavy tree growth clinging to the lower walls, but shortly thereafter we reached the wind-swept paramo and under the wings of inquisitive condors began our long trek beneath the pall of cloud and mist, which we came to call "The Shroud of Sangay." From this time on, rain fell every day for the next 26, with only occasional parting of cloud masses. Sometimes it drenched us with sudden outbursts, sometimes it swathed us in chill mist, but for the most part it contented itself with a monotonous drip, drip, drip—day after day—that gradually sapped ambition and made memory of sunnier hours seem like dim-remembered childish pleasures. When sunlight finally came, all semblance of a trail had disappeared. Our first camp was pitched at the top of a high pass to the accompaniment of bleak winds and the howling of many dogs. The Indians insisted on taking these ravenous creatures to help in hunting tapir and deer.

For several days we followed the general course pursued by Commander Dyott over three mountain ranges. Because of deserting Indians and other difficulties, few days registered progress. Throughout this period we occasionally happened on machete marks on shrub or tree, where Dyott may have passed. After the thirteenth day we descended into deep canyons and never came across any marks again. It is impossible within the limits of this article to tell the many incidents and near-disasters of these difficult days. Kaleidoscopic views are the best I can attempt.

Toward the end of a day of constant climbing, we reached the top of a pass 13,000 feet above the sea. The wind howled through the gap at a temperature close to freezing and drove us down the opposite slope for protection. Trails there were none, except the bed of a stream. For hours we stumbled and slipped over hummocks of *paja* grass, forever stubbing our toes and dropping into concealed gullies. We were thoroughly soaked. Wading the icy torrent seemed preferable to the pounding that toes and ankles were taking. The earth assumed the consistency of a supercharged sponge. We forded many streams. As the light darkened and the billowing Shroud sagged into the valley, we located the remains of Commander Dyott's camp site at Culebrillas. We pitched our tents in the driest spot of a huge morass that filled the entire floor of the valley. That same night fortune favored us. The Shroud parted for a moment, and there, 70 degrees east of south, El Sangay towered above the labyrinth of canyons. Incredibly high it stood against the southern sky, ghostly and wan in a flood of moonlight. It seemed to fill the whole end of the valley, and yet it must have been many miles away. But distance conveyed no feeling of safety when that night a severe earthquake brought us to our feet!

We had now reached the margin of the tangled mass of canyons. The front of a lava flow faced us. Our valley ran approximately southeast directly toward El Sangay, and not far away in that direction began the intricate system of water-sculptured chasms, which we termed the "Labyrinth." If we wanted to proceed into it, a route straight down the valley would mean nothing but an endless crossing of canyon after canyon. The valley wall on the southern side headed in the desired direction. We named it Dorado Mountain for the rare hummingbird we found there. It was decided that Lewis and Terris should follow the top of its ridge in order to ascertain whether it continued for any distance and might afford easier access to El Sangay.

Here Vinci, the leader of the peons, refused to go with them. He claimed rheumatism! We suspected cowardice. He even refused to let his peons advance without him, exclaiming, "There are no trails! We have to cut through with machetes!" A threat of punishment from his master, Señor Merino, brought him to terms. His sullen look as he left indicated no desire to co-operate.

As we watched the boys lightly plunge up to their waists into the Rio Culebrillas, the rest of us gave attention to the exploration of Culebrillas Valley. No zoologist had ever set foot in it, let alone entered the Labyrinth. The entire floor, 11,000 feet in altitude, consisted of a vast water-soaked swamp of paja, ex-

➤ A DOZEN PHOTOGRAPHS would be necessary to give a complete panorama of the Labyrinth from Desolation View. The entire area was once a huge plateau of black ash vomited out of El Sangay. Now it is sculptured into a network of gorges

cept at the southeast end, where it was broken by the black front of a lava flow that had its origin in El Sangay. A stunted tree growth covered the lower slopes of the mountain walls, and their gnarled condition reflected the severe climate. Small waterfalls dropped here and there, attracting a few insects which, in turn, lured five kinds of hummingbirds to the valley. All told, eight species of these iridescent creatures were found in the larger Sangay area, an astonishing number in view of its barren volcanic nature, relieved only by grass and stunted trees and practically barren of flowers.

The most conspicuous hummingbird was the huge Sapphirewing, *Pterophanes cyanopterus cyanopterus* (Fraser), whose ultramarine wings flashed back and forth through the sunlit spray of the waterfalls. It created a lasting memory of color and grace in motion. Gay's Velvetbreast, *Lafresnaya lafresnaya saül* (Bourcier & Mulsant), with its glittering black apron, fed from the orange corollas of a parasite, which festooned the moss-covered trees. The most persistent sound was the loud call of the Mountain Ant Thrush, *Grallaria monticola* Lafresnaye. Heard, but seldom seen, this bird dashed about the boggy runways. When calling, it stretched its stiltlike legs to full limit and then collapsed like a jack-in-the-box.

The most conspicuous sight in the valley were the hurtling forms of Noble Snipe, *Capella nobilis* Sclater, closely resembling our own Wilson. At twilight the ecstatic gyrations of the rarer Jameson's Snipe, *Chubbia jamesoni* (Bonaparte), whirled overhead to the accompaniment of strange sounds like a policeman's rattle of varying pitches. There were Tinamous on the paramos, Spur-winged Ducks in the streams and Red-backed Buteos[4] on the dead trees, occasionally tearing a rabbit to pieces for a clamoring youngster.

But our supreme moment of scientific excitement came with the songs of Tanagers. At the southeastern end of the valley, the Rio Culebrillas wound across to the north side along the lava flow and cut its way through to the first deep canyon of the Labyrinth. Here tree growth was heavier. Singing in the treetops was an extremely beautiful bird, brilliant in green, yellow, blue, and black. It proved to be an undescribed race of the Blue-rumped Mountain Tanager, *Buthraupis eximia cyanocalyptra Moore.* Still more startling was the discovery of a golden tanager with sky-blue wing marks, so different from all other tanagers that a new genus had to be created for it by the author. He subsequently gave to the American Museum one of the only three known specimens of this bird, *Tephrophilus wetmorei* Moore.

In other ways we were well rewarded, in spite of continuous rains. We secured many small mammals and 223 birdskins, discovered the nests new to science of several species, procured the second specimen in existence of a rare white-tailed deer, and found in the heart of the Labyrinth the unknown home of the nearly extinct Mountain Tapir.

On the third day, Terris and Lewis returned with an alluring account of the volcano that stood stark and gaunt on the skeletonic ribs of the Labyrinth and of a lofty watershed bisecting it, which proffered an opportunity to climb over its canyons. But while we discussed the possibilities, we were faced with a serious loss in personnel. Old Carlos Olalla, for 40 years triumphant victor over the wildernesses of Ecuador, had to admit defeat. Without his sage counsel and ability to understand and control the waywardness of the Alao aborigines, we would be badly handicapped.

On the following day, leaving all heavy equipment with Carlos at Culebrillas, the main party crossed Mt. Dorado to the south at an approximate elevation of 14,000 feet, laboriously cutting a way through the gnarled tree growth, and plunged into the wilderness on the other side of the range. My notes remark: We followed a stream down its boggy course, slipping in countless mud-holes. Late in the afternoon we reached the junction of three rivers completely "bogged," as the boys expressed it. A mile from our camping place we passed by the water-soaked cliff where Terris on the reconnaissance had discovered the first recorded nest of the Fiery-throated Hummingbird, *Chalcostig-*

Continued on page 238

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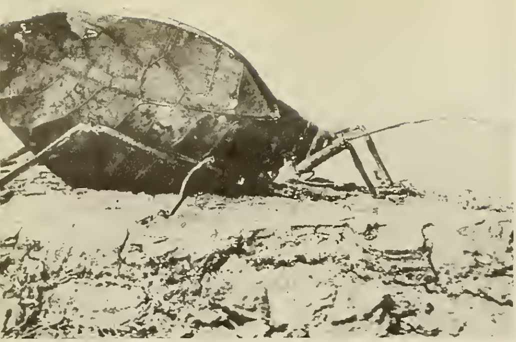
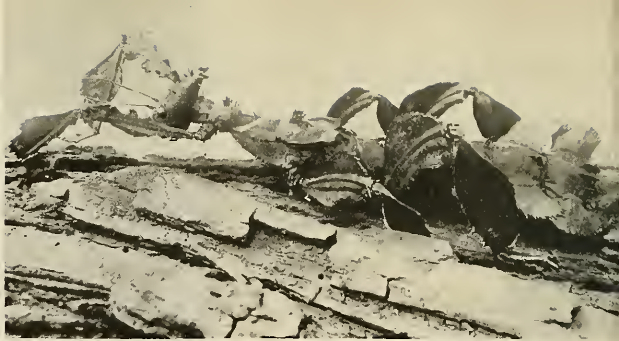
[4] *Nothoprocta curvirostris* Scl. & Salv., *Merganetta armata leucogenis* (Tschudi), and *Buteo polyosoma polyosoma* (Quoy and Gaim).



Leonhardt photo from Black Star

▲ Animal or vegetable? Not a tobacco leaf with legs and feelers but a South African long-horned grasshopper, *Cycloptera camillifolia,* neatly camouflaged from preying birds and reptiles



Leonhardt photo from Black Star

▲ Is this a withered twig stuck against the bark? Its odd-shaped thorny "leaves" blend with the background, but it is one of the insects known as the phasmids, *Extatosoma tiaratum.* It is found (by those whose eyes are sharp enough to see it) in New Guinea and Australia

HOAX or Fair Warning

Many unarmed creatures have bought security the cheap way—masquerading as animals that are dangerous or as unattractive parts of their natural background

By Lorus J. and Margery J. Milne

EVERY summer, by way of showing a few outdoorsmen the importance of a wide familiarity with animals, we point to a golden-brown insect hovering over a flower or busily seeking nectar within the blossom, and ask: "What is it?"

Our friends look at us with amazement. How can we be so ignorant? "A bee!" they almost shout.

We prod it with a finger, and it buzzes but keeps on feeding. "Don't do that. You'll get stung!" someone is sure to warn us.

By way of answer, we swoop down on the insect with open palm and snatch it from the flower into a clenched fist. Instantly the buzz rises to an angry whine. While our friends watch apprehensively, we reach in with thumb and forefinger and casually pluck out the struggler by its wings. The insect's abdomen prods around toward us as though ready to drive home a vicious sting. But nothing happens. The "bee" is a fly—the Drone Fly—an impostor that has fooled many people, as well as millions of hungry birds. It is completely defenseless but so like a honeybee in shape, size, color, and antics that a practiced eye is needed to detect the difference.

Nature is full of pretenders. Wherever we and the other animals learn by experience to expect one situation, some few creatures profit by our expectation and thereby prolong their own lives. Some creatures are strong, well armed, and ready to resist attack. Others, lacking such advantages, escape because they *seem* to be what they are not. Imitators of this sort are common all around us, but care is required to hunt them out.

A wide variety of animals evade notice because they resemble plant parts. Creeping over seaweed are shell-less snails, camouflaged by all manner of waving, leaflike appendages in a great range of colors. They are known as Nudibranchs, and they often miss detection because the gentle waving of their decorations, in time with strands of seaweed, conceals their leisurely progress from place to place. Sargasso Fish are equally difficult to recognize in their tropical and subtropical waters because of their simulation of seaweed.

Among land animals, the insects are the chief imitators of vegetation. Almost everyone has heard of the Leaf Butterfly of India (*Kallima*), in which the closed wings resemble a leaf, complete with midrib, short petiole, and some indications of branching veins. In temperate America we have other butterflies that suggest leaves, but our kinds all possess what appear to be tattered edges, as though the leaf were not only a dead one but had been lacerated by wind and winter. Sev-

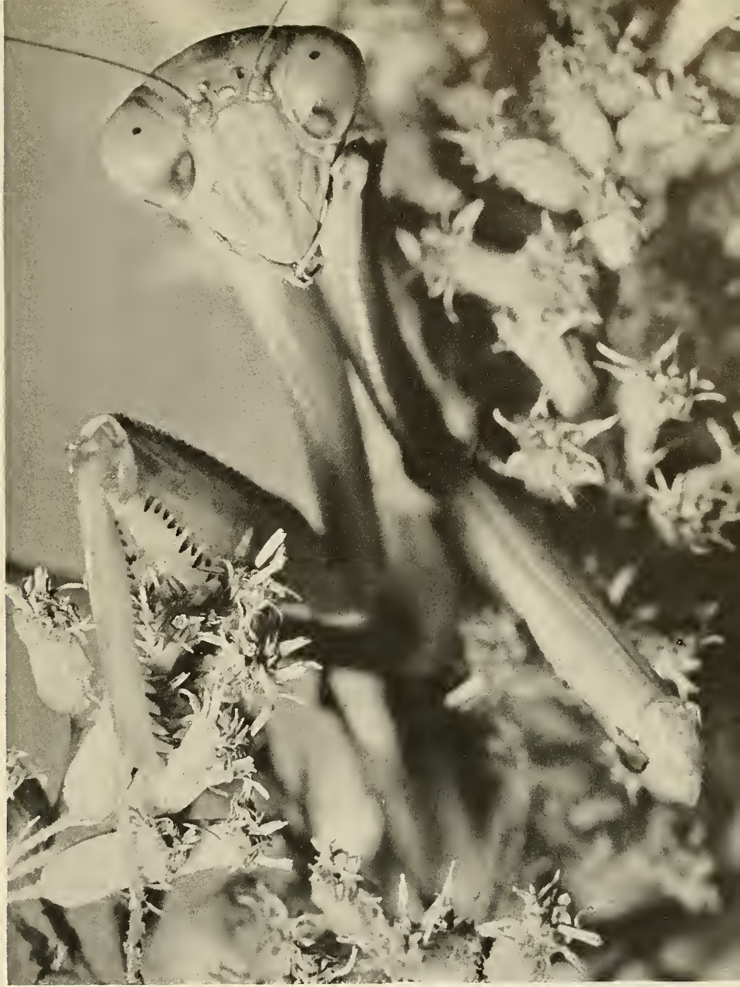


Photo by Lorus J. and Margery J. Milne

▲ THE PRAYING MANTIS matches foliage so well that it easily ambushes flies, moths, and caterpillars

eral of these ragged-wing butterflies follow a seasonal cycle that gives their resemblance to dried leaves more than coincidental significance and more than incidental value. They are active chiefly in late autumn and early spring, when green leaves are rare. They have only to cling to a branch and close their wings to disappear. In winter, they conceal themselves as adults under bark or in crevices.

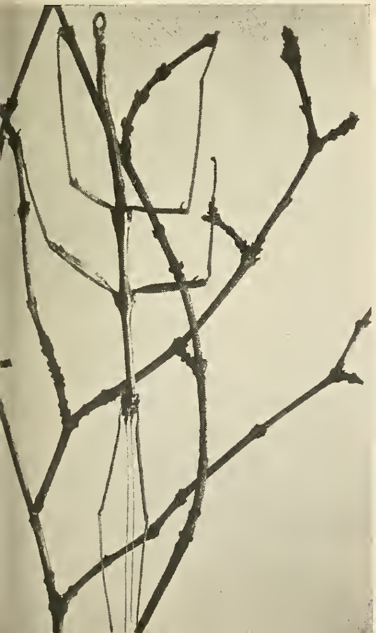
A bare stick may attract even less attention than a ragged leaf. Resting among twigs, our native Stick Insects are almost perfectly concealed, and their movements when undisturbed are so slow that the illusion is seldom destroyed. Nor do most of them descend to the ground to lay their eggs. Instead they drop them, like so many radish seeds, to bounce from leaf to leaf. They patter like rain when the insects themselves are numerous, to lie among the fallen foliage through the winter. In the spring, each pale-green stick insect emerges by a private trap door in its seedlike egg.

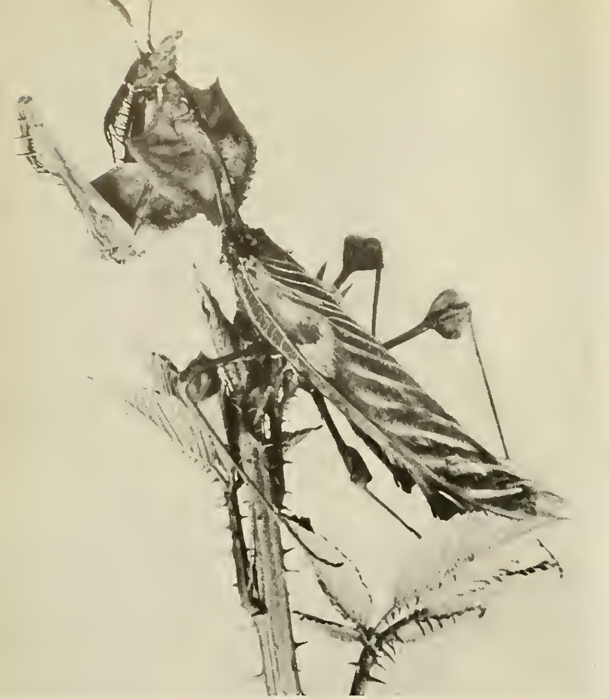
In the tropics, stick insects grow to larger sizes, and many of them are winged. Some have leaflike extensions on legs and body that look like the remains of foliage after an army of caterpillars has hurried through. Grasshoppers, too (particularly the long-horned kinds related to our katydids), show comparable diversity. Removed from their leafy homes, these green insects are seen to be ornamented by the most fanciful projections, as though each were but a caricature of a grasshopper. They are as unnecessarily decorated as a billboard embellished by crayon-wielding small boys; but Nature has not burdened them with useless impediments. These decorations help the insect to survive by blending the leaflike body with the tropical foliage.

Similarity to plant parts can also help the hunter as well as the hunted. Praying Mantises of many kinds wait hidden by the leaves, among which they stand motionless or sway gently from side to side as though tossed by a slight breeze. Such deception in the tropics may be augmented by tattered appendages of leafy green. Then along comes a fly, a beetle, or a caterpillar. The mantis' triangular head turns big eyes toward the prospective victim. Suddenly the folded forelegs extend from concealment

A STICK INSECT has a silhouette like a roup of twigs. As long as it moves slowly, may easily be passed unnoticed

Photo by Lorus J. and Margery J. Milne





Leonhardt photo from Black Star

▲ APTLY NAMED the "Devil's-Flower," this mantis of Africa conceals itself effectively among the vegetation and is a hidden trap for other insects. (*Idolum diabolicum*)

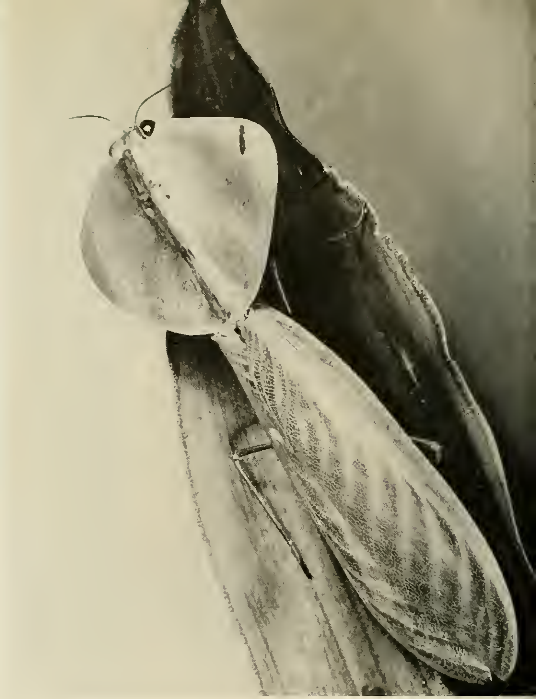


Photo by Lorus J. and Margery J. M

▲ A PRAYING MANTIS from Panama. In addition green coloration, it has leaflike extensions from its bo that heighten the illusion

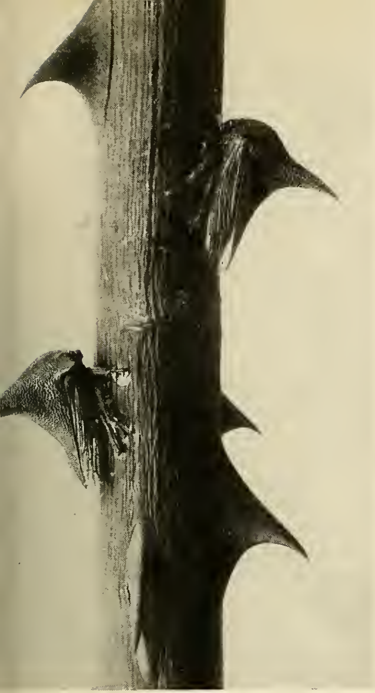
and as quickly return, with the prey clutched between. Sharp teeth on the inner surfaces of the legs provide a grip as inescapable as the spikes that lined the Iron Maiden of medieval torture chambers. The mantis is an insect trap, and its ambush technique is aided by the creature's resemblance to harmless herbage.

Much of this imposture depends upon the mantis standing still. The caterpillar that approaches may be a brown inchworm, measuring its path in a characteristic looping gait. If the mantis is so hungry that it moves toward the larva, the latter may recognize approaching doom or feel the quiver of a twig—warning enough to induce the caterpillar to use its own concealment. The inchworm may then cling to the branch with its hinder pairs of legs, while letting go with the front set of six and extending its cylindrical body as though it were a mere leafless branch, forking from the stem at an angle of some 60 degrees. As long as it retains this pose, the mantis is unlikely to attack. If the patience of the hungry mantis is less than the seeming trance of the sticklike inchworm, the bigger insect may move off and the caterpillar survive to become a flying moth with angular wings. Instinctive actions and protective appearance go hand in hand if survival value is to be achieved.

Certain birds make life precarious for many insects. But a few of the true bugs, called Tree Hoppers (or more imaginatively, "Insect Brownies"), have an extraordinary projection from their armored backs, which causes them to look like a thorn or bur. Sometimes the hopper comes to rest with the thorn pointing in the wrong way, but few birds are good enough botanists to quibble over this detail.

In evaluating protective resemblances, it is always most important to bear in mind that man's vivid imagination may suggest similarities that have no significance in terms of survival. The habits of the animal must always be taken into full account. Thus for any of our long-horned grasshoppers to escape capture by resembling green leaves, the insect must remain silent and motionless, for the most part, all day long. It can become active only after the sun has set, when most insect-hunting birds are asleep. And when the long-horns go flying through the night air, as they often do, their protective resemblance is of no avail. Some owls catch them in remarkable numbers.

Resemblance to foliage and plant parts by no means exhausts the possibilities of protective body form. Several caterpillars and a few moths spread out on leaves in an irregular mound of mottled colors that simulate closely a bird dropping splashed on the vegetation. As long as these insects remain motionless, they may be missed repeatedly by hungry birds. Similarly the many leaf beetles that have short, cylindrical bodies with irregular upper surfaces appear to be fecal pellets of caterpillars rather than objects that might contain nourishment for a bird. If disturbed, most of them retract their



Leonhardt photo from Black Star

▲ When is a thorn not a thorn? When it s a certain Central or South American tree opper, *Umbonia crassicornis*

legs and antennae into protective grooves and tumble to the ground, out of danger. Under the microscope, these beetles are beautiful—with iridescent, sculptured bodies that reflect the light. But on a leaf, with no more magnification than a bird's eye gives, their imitation of waste material is remarkably convincing.

Sometimes it is difficult to explain the strange appearance of animals by anything but coincidence. A Lantern Fly of the American tropics (*Laternaria* sp.) has an enormously enlarged, hollow projection from its head. This extension, if viewed through a hand lens, is astonishingly like an alligator's head—with protruding "eyes" above, a snout, and a long mark on each side that is decidedly similar to the elongated mouth and exposed teeth of the reptile. But what bird that fears alligators goes around with a hand lens, to be frightened by this apparition? Early explorers brought back specimens of this fairly common insect and also tall tales of how

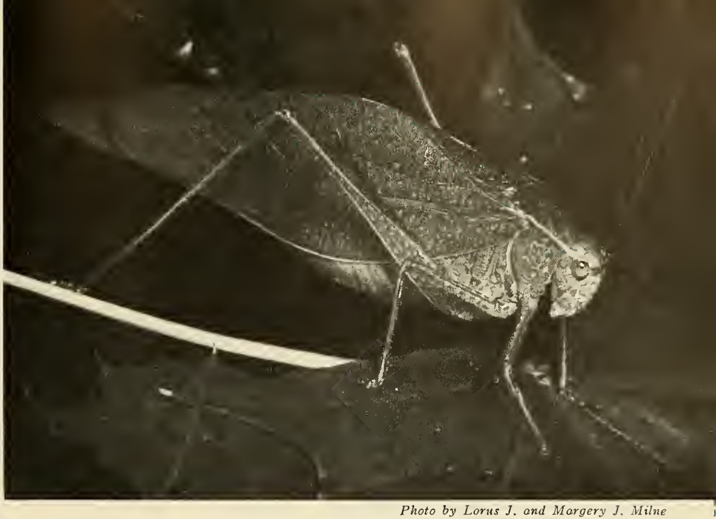


Photo by Lorus J. and Margery J. Milne

▲ This common long-horned grasshopper of New England matches its background of foliage so well that the naturalist may have to search closely to find it: another example of resemblance having survival value

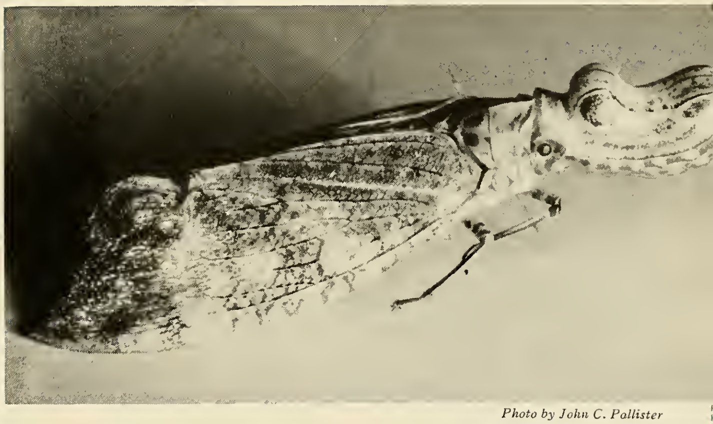
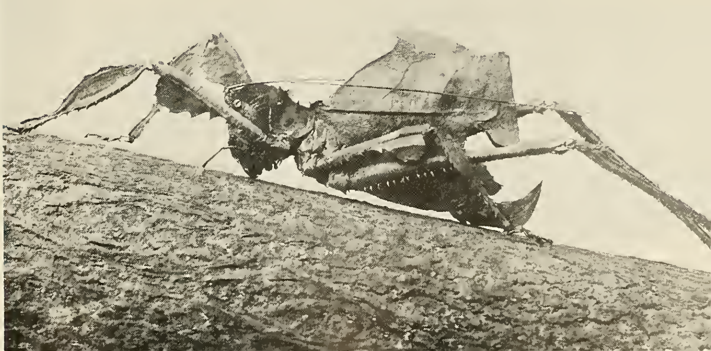


Photo by John C. Pallister

▲ If sufficiently enlarged, the fore-part of a lantern fly reminds us of an alligator's head. But it is doubtful that any of the insect's enemies would be frightened away by such a comparison. This seven-inch specimen from Peru, though large for an insect, is far below the dimensions of an alligator

▼ A West African long-horned grasshopper that simulates a withered leaf: the masquerader known as *Acridoxena hewaniana*

Leonhardt photo from Black Star



its head glowed like a lantern in the dark—hence the name "lantern fly." All large museums receive examples each year, sent in as "rarities." The luminescent story has not received verification. And so far, no one has produced an adequate explanation for the extraordinary development of the lightless lantern fly's head.

Sometimes it is difficult to imagine why a certain insect is avoided by an animal. A number of Ghost Crabs (*Ocypode*) that shared the authors' apartment one summer were tested repeatedly with freshly caught insects for food. All were highly acceptable—except fireflies. These were either rejected or ripped apart and then thrown away. Yet toads sometimes eat enough fireflies to turn them into animated lanterns, the unquenched lights shining through the stomach wall.

Many animals learn what may be eaten and what may not by trial-and-error methods. A bird clearly develops a tendency to avoid a hornet or a stinging caterpillar after a single try has proved distressing. The insect eater learns to distinguish the objectionable prey (and anything resembling it) as thoroughly unsuitable for food.

An insect that is avoided because it is recognized as an unpalatable, malodorous, poisonous, stinging, or biting creature does not need camouflage. In fact, bold coloration with a maximum of contrast would help to advertise its presence. Sure enough, skunks are plainly marked in black and white—the utmost of contrast—and they walk about so deliberately, fearing no attack, avoiding no enemy, that motorists and locomotives run them down by the score. Yellow and black Zebra Butterflies, and others of the heliconiids which are known to be distasteful to monkeys and birds, are vividly banded. Young animals will try one heliconiid butterfly but not a second. Like the skunks, these insects bear clear warning patterns and can afford to be most deliberate in their movements.

The many kinds of bees and wasps resemble each other more in color and pattern than would be expected in so large a group. But as Fritz Mueller pointed out in the middle of the last century, stinging insects enjoy a distinct advantage if they have a general similarity in appearance. If each kind of stinging bee and wasp had a different appearance, a much larger number of individuals would be killed in educating each bird than if a lesson learned from one experience could apply to many. Hence, evolution seems to have favored the development of similarity among these well-armed insects.

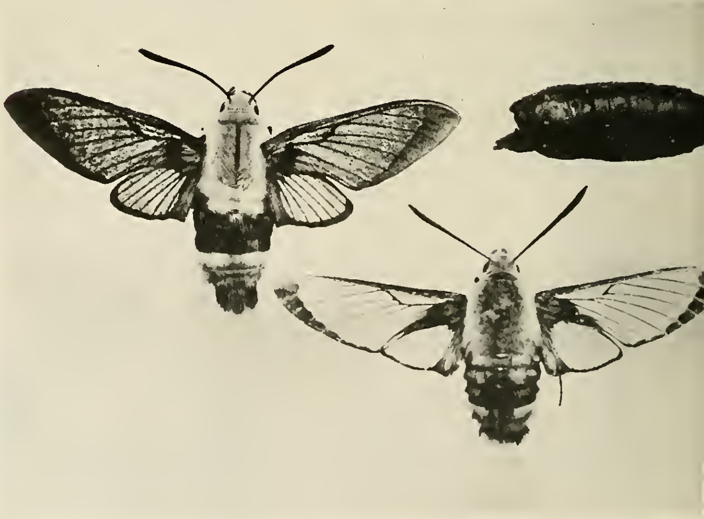
A badge of immunity may be counterfeited. The drone fly, so like the honeybee, demonstrates how freedom from attack may be achieved by a lamb that wears wolf's clothing. The closer the resemblance, the fewer times a drone fly is eaten by a bird. The flies frequent the same flowers as the bees and mimic them wonderfully well. Even the robber flies that attack honeybees to suck out the contents of the honey-gatherer, using a technique that protects them from being stung, follow the same procedure with the drone flies, which could not sting if they wanted to. The carcasses of both insects often accumulate under a favorite perch of the hairy, predatory flies—as a cemetery of empty shells, mimic mixed with model.

The drone fly belongs to a celebrated group of aerial acrobats with perfect wing control—the Hover Flies. They are members of the family Syrphidae. Many of this great group of interesting insects mimic the bees and wasps in body form, pattern, and habits. Some are slender like hornets, others robust like bumblebees. A few of them use their disguise to enter undetected into the nesting areas of the more industrious bees in order to rob them of their food stores or lay eggs that will hatch to maggots and fatten at the bees' expense.

Even beetles mimic bees, particularly bumblebees, and frequent flowers. The so-called Bumblebee Flower Beetle (*Euphoria*) is often seen in spring, flying a few inches above the ground in nicely controlled flight, entering among canes and other low-growing vegetation, humming very much as does a home-hunting bumblebee. In the South, the Figeater is another scarab that is easily mistaken for a bumblebee as it visits flowers and

▼ BUMBLEBEE HAWK MOTHS quickly lose their dark wing-scales after emerging fro the pupa at upper right. Then, with clear wings (*lower right*), they flit from flower t flower like a bee and enjoy the protection of a sting they do not possess

Photo by Lorus J. and Margery J. Miln



ripe fruits. The curled, white, grublike young of these insects feed upon roots, however, and the parents make no known use of their similarity to bees except as it frees them from attack by birds.

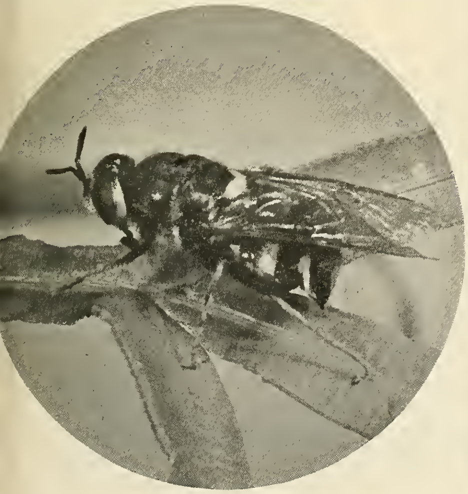
A few moths that are active by day are readily mistaken for stinging insects. The Bumblebee Hawk Moths emerge from their pupal shelters in the earth with a full covering of overlapping scales on their wings, just like those worn by others of the Sphinx group. But most of the scales fall off as soon as the wings are used, and before long the insect is as clear-winged as a bee. Even the antennae are shorter, blacker, and more clubbed, as though in imitation of the prominent elbowed antennae of the armed insect. Clearwing moths of the more slender aegeriids have a closer resemblance to wasps and are active on the same flowers at the same time of year. Presumably they enjoy freedom from molestation by virtue of the "pointed arguments" the stinging models carry.

Ants, too, have their mimics. Some longicorn beetles and several true bugs resemble ants in markings, body dimensions, and manner of walking. But an assortment of insects from various groups actually associate themselves with ants, acquire the odor of the anthill, and roam about freely within it. They feed on the stores of food that the ants accumulate and even beg drops of regurgitated nourishment from their passing hosts. These "guests," properly called inquilines, form a most interesting addition to the anthill population. There can be no question but that their similarities benefit the mimics.

If it is to profit by the disguise, a defenseless animal that resembles an armed one must always frequent the same places as the model, at the same time of day and year. The Leaf Fish, *Lobotes surinamensis*, is an interesting case in point. The young of this fish closely resemble the floating dead leaves of the red and black mangrove among whose leaves they make their home. And when a handful of the leaves was tossed into an aquarium containing one of these fish, it immediately moved toward them and literally "schooled" with the leaves. It lives on its side near the surface, with its body curved downward in a slight arc and often with its head slightly lower than its tail. It moves lazily through the water by means of transparent pectoral fins, so that there is no appearance of muscular activity. The fish is yellowish-tan, marked with brownish-black spots, and it reaches the right size at just the right time. In summer, the leaves are bright green, but in the autumn, when most of them fall, they turn yellowish and finally brown or nearly black. The fish apparently reaches the right size to enjoy protection when the leaves themselves have come to resemble the fish most closely.

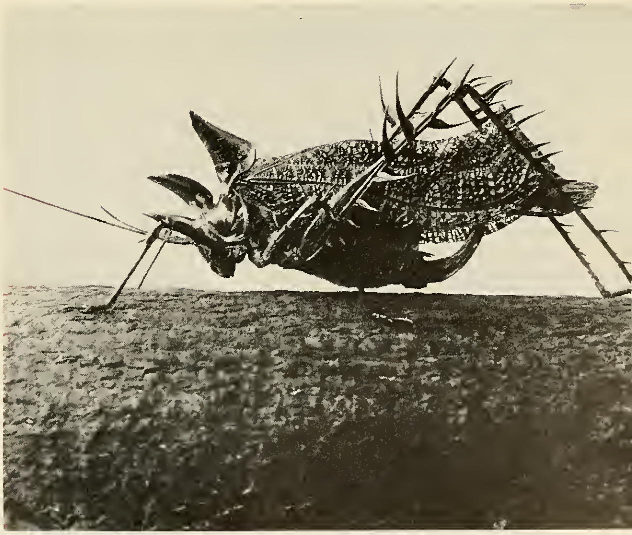
It was Henry W. Bates, an explorer of the Amazon basin a century ago, who first pointed out that harmless and dangerous creatures are sometimes encountered in the same region and in a similar guise. This sort of mimicry has been called Batesian mimicry ever since. We see an example in the harmless Harlequin Snake, which lives in the same territory as the poisonous Coral Snake. Though unrelated, it has the same alternating bands of scarlet, black, and yellow—though in a different pattern. If one does not memorize how the colors alternate, it may not be easy to tell the poisonous snake from the harmless one on

Continued on page 239



A FLY that looks like a wasp. The Soldier Fly has
non-yellow bands arranged like those of the wasps
at frequent the same flowers. It also has conspicu-
s antennae that are elbowed like those of the sting-
g bees and wasps

Photo by Lorus J. and Margery J. Milne



▼ A GROTESQUE EXAMPLE of leaflike mimicry: a long-horned grasshopper (*Markia hystrix*) from Panama, Colombia and Brazil

Leonhardt photo from Black Star

New Mexico State Tourist Bureau pho

THE *Great White Sands*

Our most extraordinary desert beckons those who seek the truly bizarre—a curious assemblage of persevering plants and ghostlike animals struggling amid a snowy sea of dunes

By NELL MURBARGER

MICE and lizards of snowy whiteness, yuccas with stems 40 feet long, sand that isn't sand, lakes of crimson water—these are some of the tales that are told of New Mexico's Great White Sands. Thrice difficult is it to winnow the wheat from the chaff—to declare with certainty, "This is fact" or "This is fable." Chiefly this is so because there is still much unknown about this strangest and most spectacular of our deserts—this 176,000-acre wilderness that looks like a stage setting of the Sahara done in granulated sugar.

These undulating white dunes extend across more than 200 square miles of territory and bear no relationship to silica or quartz sand, being composed of 99 per cent pure gypsum crystals and 1 per cent quartz and other impurities. They were already known to Spanish explorers when Virginia was still a struggling colony of the Crown.

When pioneers first settled in the Tularosa Basin, in what is now south-central New Mexico, they felt only hatred and distrust for these ever-shifting hills, fearing that the dunes would eventually swallow homes and ranches, even the growing settlements. Yet even as they feared the spectacular white sea, these early settlers found themselves drawn irresistibly toward it; and whenever time and Indian troubles permitted, they packed lunch hampers and journeyed by horse and buggy to "The Sands," there to spend a day picnicking and playing.

Closer acquaintance saw the earlier dread replaced by a feeling of friendliness, and as the population increased roundabout, the sands became a popular site for

ERICA'S "LITTLE SAHARA" covers 200 square miles and is composed ifting dunes of almost pure gyp- gleaming white like granulated

Western Ways photo by Ray J. Manley

▲ THE TRACKS of yesterday are erased tomorrow in the dunes of the Great White Sands. But troublesome sandstorms occur only when the wind is very high

church suppers, lodge gatherings, Sunday School picnics, Easter Egg hunts, weiner roasts, school play-days, and moonlight frolics. But all these visits were strictly marginal affairs, and until fairly recent times the heart of the Great White Sands remained virtually as little known as the Gobi. Not only was it a land completely devoid of surface water, said local legend, but it was a place where no form of life existed—plant, animal, or insect—a gleaming wasteland, as barren as the arctic and as hazard-fraught.

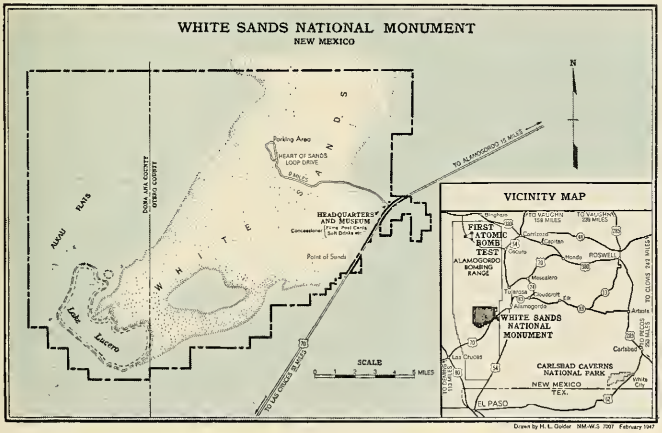
In these same White Sands, however, people of the Tularosa Basin realized that they had a scenic wonderland unlike any found elsewhere, and about 1922 they began a decade-long fight to set aside a portion of the area as a National Park or Monument. The late Tom Charles, then Secretary of the Alamogordo Chamber of Commerce, was named Chairman of a special White Sands Committee. Year after year, Charles made the Sands project his special baby, working either alone or in co-operation with Sands-minded officials of other communities as far distant as El Paso.

While Secretary of the Interior A. B. Fall and New Mexico's U. S. Senator Bronson Cutting were both giving the issue their wholehearted backing, there was the usual opposition from enemies of conservation. At last, about 1929, a government representative was sent to appraise the merits of the place. Arriving there he found a region whose fringes had been overrun by picnickers for two generations, while its interior, so far as he could learn, had been seen by no man except from a distance!

It was Tom Charles, naturally, who accompanied the official party in the capacity of guide and general trouble shooter. The "invasion" was no sinecure; not even a wagon trail had ever been built into the region. From the south and west, entry is precluded by the several thousand-acre expanse of swampy Lake Lucero, while from the north or east the steep lee sides of the dunes present a formidable appearance. It is impossible for a vehicle to climb the leeward faces, but the flats between are firm, and it is possible to follow a zig-zag course.

"After four and one-half hours . . . of shoveling down the sand-hills and throwing in scattered stalks of yucca to make the road passable," wrote Mr. Charles in his description of that initial inspection tour, "we arrived at a point where we were satisfied that we were in the Sands proper."*

By the time this exploratory journey was completed, Uncle Sam's representative was fully convinced that this was one of nature's true marvels—an area unlike anything else in the world and certainly a place worthy of recognition as a National Monument.


WHITE SANDS NATIONAL MONUMENT
NEW MEXICO
N
WHITE SANDS
Parking Area
HEART OF SANDS LOOP DRIVE
9 MILES
TO ALAMOGORDO 15 MILES
HEADQUARTERS AND MUSEUM
Concessioner {Films Post Cards Soft Drinks etc.
Point of Sands
ALKALI FLATS
DONA ANA COUNTY
OTERO COUNTY
Lake Lucero
70
TO LAS CRUCES 33 MILES
SCALE
0 1 2 3 4 5 MILES
VICINITY MAP
Bingham
TO VAUGHN 159 MILES
TO VAUGHN 239 MILES
FIRST ATOMIC BOMB TEST
ALAMOGORDO BOMBING RANGE
Carrizozo
Capitan
Oscuro
Hondo
ROSWELL
Mescalero
Tularosa
Cloudcroft
Elk
Alamogordo
Artesia
WHITE SANDS NATIONAL MONUMENT
TO CLOVIS 242 MILES
TO PECOS 253 MILES
Carlsbad
Las Cruces
CARLSBAD CAVERNS NATIONAL PARK
White City
NEW MEXICO
TEX.
EL PASO
TO DEMING 113 MILES
380
54
70
74
83
13
285
80
62

Drawn by H. L. Golder NM-W.S 7007 February 1947

Others, unfortunately, held quite

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*New Mexico Magazine, July, 1932.

Photo by Hubert A. Lowman

▲ WHERE THE WIND endlessly writes its autograph: a brilliant world of curves and timeless change. Some of the dunes are 50 feet high

different views. While this great white desert had lain unused longer than any man knew, commercial interests rose in alarm as soon as it was under serious consideration as a park reserve. As one of the world's largest gypsum deposits, they declared, here was potential revenue far too great to be "wasted" on recreation alone. They cited the staggering value of the Sands for fireproofing material, for wallboard and tile, wall plaster and exterior stucco; as plaster of Paris and casting plaster for surgeons and dentists; as a retarder in Portland cement and a filler in paint, paper, and fabrics; and as a fertilizer and soil conditioner. In short, the world was suddenly represented as turning on axles of gypsum.

Such protests were laughed down when it was statistically shown that the Great White Sands deposit contained a conservative *thirteen billion tons* of gypsum—a supply sufficient, it was declared, "to reproduce the fireproof walls of every skyscraper in America, to duplicate every piece of wallboard that has ever been manufactured, to replace every piece of inside decoration and statuary on the American Continent . . . and still not interfere with the one-third of the Sands which is to be set aside as a national playground."

Accordingly, in January, 1933, the choicest portion of the Sands was designated as a National Monument, and the first road into the dunes was built. On April 29, 1934, the new Monument was opened to the public by the man who had led the ten-year effort for its creation. He had been appointed Custodian at a salary of one dollar a year.

"Naturally, that salary wasn't all velvet," Tom Charles liked to remark in later years. "I had to furnish my own car, gasoline, and postage stamps . . ."

During the first year of Monument status, the dunes were visited by 34,000 persons, and the number nearly doubled during the second year. Today, as America's sand pile extraordinary, this strange white desert is the playground of some 150,000 persons annually, the peak attendance to date having been recorded on July 4, 1949, when 7,890 persons passed through the entrance gate.

Yet, of all those who come here

Western Ways photo by Ray J. Manley

◄ CRYSTALS OF SELENITE, from which the "sand that is not sand" is formed to frolic, comparatively few know the true story of the Sands. Even geologists long disagreed on the origin of the dunes. Some contended that rain and melting snow had carried thousands of tons of gypsum in solution from the surrounding mountains, depositing it in the broad, shallow expanse of Lake Lucero, a natural evaporating pan at the southwest end of the dunes area. Gradual disappearance of the lake water leaves a huge expanse of glittering gypsum crystals. Early geologists believed that the prevailing southwesterly winds caught up this material and carried it to the northeast, there to form the long windrows of dunes.

Western Ways photo by Charles W. Herbert

New Mexico State Tourist Bureau photo

▲ THE GREAT WHITE SANDS provide a favorite picnic ground. But a generation ago the interior of the desert was almost unknown

◀ THE DAZZLING LIGHT of the noonday sun can produce "snow blindness," and sunburn is a frequent penalty for wearing beach costumes in these sealess sands

▼ THE FLATS between the dunes are mostly hard enough to drive over. Cars are now prohibited on the dunes because reckless driving down the steep slopes became hazardous

Ormal I. Sprungman photo

To be sure, this operation is actually going on at Lake Lucero as it has for possibly a million years past, but students of geology now realize that the manufacturing process of the Great White Sands operates on a scale far greater than first believed. Today's explanation is that a great plateau once extended across much of southern New Mexico. Later, a huge block of this high country settled to form the present Tularosa Basin, between the San Andres Mountains on the west and the Sacramentos on the east. Because these flanking mountains were recognized as the

Western Ways photo by Charles W. Herbert

▲ THE SAND CASTLES and man-tracks of the holiday-seekers are obliterated as soon as a breeze resmooths the dunes, and a virgin expanse of snowlike sand awaits the next visitors

remaining ramparts of that plateau, and because both ranges carried gypsum, it seemed logical that the sunken portion of the plateau would be likewise endowed. Drilling the basin floor, geologists found beds of Permian limestone and sandstone, between the layers of which were thick beds of pure gypsum.

With this discovery was born the modern theory that, while the Great White Sands are partially the result of evaporation at Lake Lucero, a much greater portion of the gypsum comes from this underground deposit. Water passes to the surface through capillarity, dissolving the material and bringing it up in solution. Upon reaching the earth's surface, this mineral-laden water evaporates, leaving on the flats between the dunes a salt-like encrustation of pure gypsum crystals, which crumbles at the touch.

Distribution is a simple matter of wind erosion. Every passing breeze, playing its fingers over these crusty flats, loosens the crystal grains and whisks them away to pile on the rising dunes to the leeward.

This, then, is the well-organized factory of the Great White Sands—a plant that operates day and night, winter and summer, year in and year out, without labor troubles and presumably without danger of either overproduction or eventual exhaustion of natural resources.

From Monument headquarters on U.S. Highway 70, a side road leads to the heart of the Sands through a narrow swale bordered on either side by rippled white hills. It is a good road over which motorists travel smoothly and safely; yet the battle for its possession is a never-ending issue between Monument maintenance crews and the forward-marching dunes. Only by constant use of bulldozers and scrapers can the invasion of the sands be met and the way kept free for travel.

For the first several miles out of Monument headquarters, the Sands road leads through a marginal world where bird songs are occasionally heard and scattered vegetation is still to be found. Even here it is obvious that preservation of life is no simple matter.

Probably no other botanist has devoted so much study to the plant life of Great White Sands as Dr. Fred Emerson, Professor of Botany at New Mexico Highlands University, who has collected here 62 species of plants. While seven of these species are so constituted that they can push upward fast enough to keep from being buried by the dune and thus appear to be growing out of the gypsum itself, Dr. Emerson has found that all species must necessarily be rooted in the stabilized flats, either beneath or between the dunes. In some sections of the Sands, particularly near Miracle Point, the only two species of plants known to occur are the purple sand verbena and the burroweed.

The fact that plant life exists in the dunes is in itself a phenomenon of nature, since the sands are completely devoid of nitrogen. Either the plants must "muddle through" without it—a feat not commonly believed possible—or they must derive it from the underlying material or contrive, in some manner yet unknown, to extract it from the air.

Of the 60-odd species frequenting the region, none shows greater adaptability than the yucca. Like small boys striving to view a circus parade over the heads of the crowd, these spiny fellows seem to stand on tiptoe, stretching their necks to the utmost limit in an effort to keep their heads above the encroaching sand. Sometimes only a handful of dagger-tipped leaves marks the burial place of such a yucca, but the leaves will still be green.

Later, as the dune moves on, the disproportionately tall stem is exposed and the crown may be seen teetering precariously in the air. Instances have been known where such yucca stems attained a length of forty feet, nearly ten times their normal stature. Occasionally the gypsum crystallizes to form a hard, tubular casing around the stem, giving it the appearance of a stalagmite or column. In other instances, the sands are so thoroughly bound together by the roots of a plant that after the dune proper has moved on, the closely-knit hillock remains

➤ NOT A MOUNTAIN RESORT but ski
thrills equivalent. The gypsum sand
much like dry snow

intact, with the plant that caused it still perched on its summit like a golf ball on a tee.

On flats between the dunes one finds Indian rice grass, tufts of grama grass, wiry, gray rabbit brush, burroweed, and ephedra. Now and then there is a small skunk brush or stunted cottonwood tree.

Possibly nothing in this marginal world endures a grimmer struggle for existence than these little cottonwoods. As the encroaching dune creeps slowly higher on the tree's trunk, the sand methodically swallows the lower branches one after another. Deprived of air and sunlight, these branches die, and, as time goes on, roots sprout in their stead. When, in the course of months or years, the dune passes on its way, its departure disentombs the buried portion of the plant, and if life still exists, new branches again sprout from the trunk. The confusing result is an upside-down tree with unanchored black roots and leafy green boughs haphazardly and hopelessly intermixed.

Nell Murbarger photo

▲ WHEN THE SKY BECOMES OVERCAST and the sky line is blotted out by wind-blown sand, the visitor may lose his way in the labyrinth of dunes. A tent has been known to become buried in a day

That this marginal world also has its share of animal life is apparent in the intricately patterned tracks that lead from the crusty lowlands to the tops of the highest dunes. Recorded in the sand as faithfully as in new-fallen snow are sprawly lizard tracks and bird tracks, the decisive thumps of strong-limbed jack rabbits, the dainty imprints of tiny cottontails, the doglike pads of foraging coyotes. For a dozen yards the delicate tracery of a pocket mouse's footprints are overlain by the pigeon-toed stride of a cruising desert skunk. Suddenly the rippled surface of the sand shows unmistakable evidence of disturbance, and a single drop of dried crimson stains the white expanse. The skunk tracks continue their pigeon-toed course across the dune. The mouse tracks are no more.

New Mexico State Tourist Bureau photo

Nowhere has protective coloration been developed to a higher degree than here in the Sands, particularly by animals that are commonly preyed upon by their neighbors. Dr. Lee R. Dice, of the University of Michigan, made an exhaustive study of pocket mice in the Tularosa Basin. He found that in the lava beds a little to the north of the Sands these rodents are nearly black in color, thus affording them protection in the dark lava rocks. In the red hills near by, the pocket mice have definitely reddish fur; while in White Sands they are pale straw color. An interesting diorama showing the three color phases in their natural habitats may

Western Ways photo by Ray J. Mant

▲ PLANTS manage to survive the encroaching dunes. Some yuccas have had to elongate their stems 40 feet in order to stay above the surfac

be seen in the museum at Monument headquarters.

White spiders also are said to occur here, and it is not unusual to glimpse small white lizards, whose pale ghostliness renders them all but invisible against the dunes where they spend their lives. An earless lizard (*Holbrookia*), described as an endemic race, and a scaly lizard (*Sceloporus*) are nearly pure white. Also there is a whiptail lizard (*Cnemidophorus*), which is considerably paler than those immediately outside the dunes.

Not all creatures, however, are endowed with this protective camouflage. Brewer's blackbirds are still black, and to see a flock of these glossy fellows alight on the gleaming sands provides one of nature's most striking studies in contrast.

Before the visitor has been long in the Monument, he is certain to note that all the dunes have one characteristic in common, which formerly encouraged a remarkable type of daredeviltry. Due to the prevailing southwesterly winds, the dunes have a gently sloping grade on their southwest exposures, while their leeward faces drop away with relative abruptness. For all its soft and velvety appearance, the crystalline material composing these dunes is heavy and firmly settled; and until Monument authorities forbade the practice, it was considered rare sport to travel over the dunes in a speeding motor car.

Zooming across the windward incline to the summit of a dune, the driver would cut the power just as his machine, in roller-coaster fashion, headed down the steep northeast declivity. With the hilarious and terrified shrieks of passengers lending drama and confusion to the experience, the car would go into a nose dive, its wheels locked and the whole propelled forward on the crest of a miniature avalanche. Reaching the base of the dune, the machine would somehow recover its balance, zoom off across the flat and up over the crest of another dune, there to stage a repeat performance.

As visitors increased in number, the practice grew extremely hazardous, and frequent signs along the road now warn against such indulgence.

Five or six miles from Monument headquarters, virtually the last of the vegetation grows, and another couple of miles carries the motorist to the end of the road. Beyond this point exploration must be on foot.

Trudging across the flats, up one

dune and down another—particularly during midday hours when the sun is high—the visitor feels he is walking through a glaring white vacuum in which nothing is real. Like a sleepwalker, he automatically lifts his feet and sets them down, yet the only evidence of progress lies in the lengthening trail of footprints he leaves behind him. To the right and left, ahead and behind, the undulating white dunes stretch away to the distant mountains. Unless shielded by dark sunglasses, few human eyes can long endure the brilliancy of this midday light, its effect being similar to the snow blindness experienced by arctic travelers.

By far the best time to see the dunes is during the first two hours after sunrise and the last hour or two before sunset. Then the low-slanting rays of the sun throw heavy shadows into the ripples and accent every slope and contour.

Photographers using light meters are apt to find that the intensity of light is even greater than their gauges will register. Picture-snappers are almost certain to overexpose their film unless they use one of the fastest shutter speeds and smallest lens openings available.

Considering this intensity of light and the complete absence of shade and surface water, one might expect this white wasteland to be an inferno. Quite the opposite is often true. The breeze that blows across the dunes frequently has something of the quality of a sea breeze, and even on the warmest days the surface of the sand may feel cool to the touch. The absence of shade and the strong reflection of sunlight from the sand can make sunburn a problem.

Near the far end of the motor road, on one of the wide flats between the dunes, is situated a large picnic ground and parking area. The National Park Service has provided stoves, tables, and benches, with pole ramadas for shade; and here several thousand persons come to disport themselves each Sunday throughout the season.

Something about the dunes seems to cast a strange spell over sojourners, and only a dyed-in-the-wool hermit could fail to find this picnic ground an interesting place in which to study humanity. Possibly its nicest feature is the almost complete absence of Thou-Shalt-Nots. Here, at last, is something that the Great American Public has discovered no way to damage.

Before the last weiner has been roasted and the last campfire has died to smoldering embers, the average Sunday evening at Great White Sands sees the picnic area tramped, tunneled, tumbled, and turned upside down. But long before another week end has rolled around—generally within 24 hours—the sand castles are leveled, the pirate caves refilled, and man-tracks obliterated, leaving the area again spotless, perfectly sculptured, and self-possessed. Responsibility for this amazing clean-up job lies with the wind, which plays lazily over the dunes, moving the sand forward on a 30-mile front at an average rate of several inches each year.

Harrowing tales of blinding sandstorms in the Great White Sands are sometimes told. It cannot be denied that a person without a good sense of direction might become lost under certain circumstances. When the wind is high, all landmarks sometimes remain obscured for hours. One scientist familiar with the region traveled in a sandstorm all day under a cloudless sky without ever seeing the sun. And when he returned to his tent, he found it entirely covered with sand. But in any normal wind, the crystallized gypsum only rolls along the surface, and if a handful is tossed into the breeze, it falls back to the ground, leaving almost no trace of dust in the air.

A story has gotten started that a herd of antelope makes its home here and has hooves that curl back like a court jester's cap, because of lack of grit to wear them down. But Monument Superintendent Johnwill Faris has never encountered such an animal during his ten years at Great White Sands, and for lack of evidence we must put the tale down as highly doubtful. Yet the story still persists, and any number of reputable persons in the Tularosa Basin will swear to its authenticity.

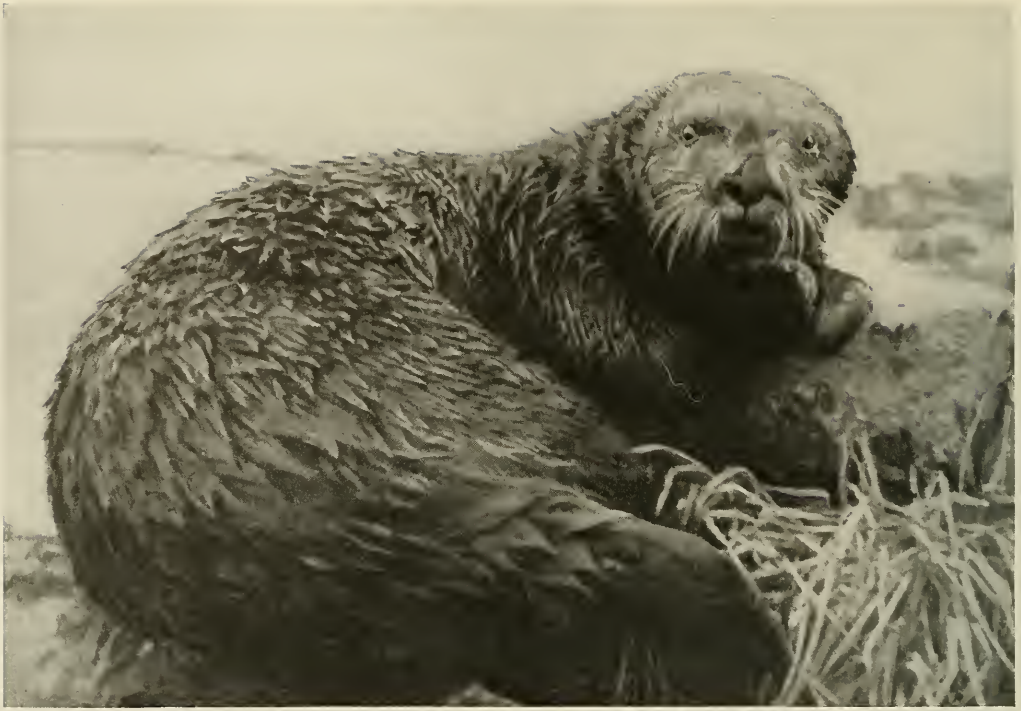
Then there are the transient lakes of vermilion-colored water. Spanish legends dispose of the matter conveniently by asserting that the lakes are visible only on the anniversaries of certain bloody battles. Cattlemen of the region, on the other hand, declare that the strange pools make their appearance with considerable regularity, generally in the fall of the year.

When I put this question before the New Mexico School of Mines, they parried with one of their own: "Did you ever *see* one of these lakes?" I have not. But Natt N. Dodge, Regional Naturalist, asserts that, although descriptions have exaggerated them, he has seen patches of "red" water in Lake Lucero, probably in September. What appeared to be concentrations of algae in small lagoons along the shores of the lake gave a distinctly red cast to the water.

There is still much for us to learn about the Sands. Probably no man ever knew them so thoroughly or loved them so devotedly as their first official custodian, Tom Charles.

"To you who have never seen the Sands," he wrote, shortly before his death, "I want to invite you to come, and I hope that you see them on an evening just as the setting sun breaks through a canopy of clouds above the rugged San Andres, painting the points of the hills in yellow and gold, with here and there a burning ball of fire; that the mountains themselves are purple and blue and the deep shadows of the Sands stand out against the snow white hills . . . As you linger in the twilight . . . peering into the darkness and listening to the silence of the desert, without the whisper of a single leaf, I hope that you turn, half frightened, and face the full red moon as it rises over the Sacramento Mountains, scattering its millions of diamonds over every rippled dune.

"Then you will have seen the Great White Sands."



U. S. Fish and Wildlife Service photo by Warden Carl Loy

▲ THE ADULT SEA OTTER looks like an old man, with grizzly hair and bristly mustache, but it lives and plays like a child. At maturity, it is 55 inches long and weighs 50 pounds

MORE Sea Otters

Under the protective eye of the Fish and Wildlife Service, these fabulous "old men of the sea" are returning from the verge of extinction

BECAUSE sea otter pelts were worth their weight in gold when the Russians came to Alaska, the animal was hunted relentlessly and was eventually all but exterminated. Some pelts were said to have sold for $2500, though the average was much less. In the mad struggle for the fur trade, the early traders from Asia enslaved many of the native men, working them to death or killing them before sailing away, and there was mass murder of whole settlements of native Aleuts.

Soon after Alaska was acquired by the United States, killing of this unique animal was rigidly curtailed, and in 1910, when the otter seemed doomed, complete protection was given. During the last decade, a long-range program to increase its numbers has been under way. It is now reported that there are more than 8000 sea otters in the Aleutians-Alaskan area. These are independent of a small herd that has been rigidly protected by the state of California. In former times, sea otters were found all along the Pacific Coast.

Few photographs of the animal existed before the ones shown with this article were taken. The U.S. Fish and Wildlife Service is undertaking to create new colonies through the transplanting of small numbers to favorable areas.

During the early part of this century, about all that the Federal Agencies that were charged with the protection of the sea otters could do for the animals was to maintain secrecy about the location of small groups that were known to exist. The Agencies did not have the necessary funds for much patrol work. In the 1930's, however, the Navy and Coast Guard gathered evidence indicating that Japanese "fishing craft" might be netting sea otters illegally in Alaskan waters. It was the sighting of a Japanese vessel, indeed, in an inlet of Amchitka Island that started the present management program. The seagoing ship had entered an inlet where no ship could possibly be afloat—according to Navy charts. The charts indicated that the inlet was filled with rocky reefs, which would surely destroy any ship. The Japanese ship, however, on sighting the Navy vessel, put on steam and sailed away, right over the "rocks." Investigations showed that the "rocks" were really rip tides that created an illusion of reefs.

In the inlet was found a large group of sea otters. Hidden away from hunters and pirates, the otters had lived and multiplied for many years. The Bureau of Fisheries then received a small appropriation from Congress for the establishment of a sea otter station on Amchitka. When the Bureau of Fisheries and the Biological Survey were consolidated in 1940 to become the Fish and Wildlife Service, the sea otter management program was given impetus.

During the war years, sea otters began to multiply in their relative security. Now there are about 4000 on Amchitka and about the same number scattered in small groups along other islands and coastal areas.

The Fish and Wildlife Service reports that the sea otter cannot live except along certain shore lines. It needs an area where the water is comparatively shallow, as off shelving beaches. In such localities sea urchins live, upon which the otters feed mainly. There also must be kelp beds, in which the otter can rest, play, and hide from killer whales. Killer whales and man are the sea otter's two worst enemies. The otters are constantly on the alert for them, occasionally shading their eyes from the glare of the sun with their paws to look for the single large fin of a killer whale cutting through the water or to spot man's boats approaching.

The sea otter has so many of the characteristics or mannerisms of people that it is often called the "child of the sea" or "old man of the sea." The two names are not as contradictory as they first appear. While the 55-inch long, 50-pound adult looks like an old man, with grizzly hair on head and shoulders and a full, bristly mustache, it lives and plays like a child. The sea otter undulates through the water with a scissors kick, now and then rolling over on its back to kick itself along with one foot—its forepaws complacently resting on its chest. The sea otter's chest also serves as its table. On it, the otter spreads sea urchins as it tears them apart. While nibbling one tasty bit, the animal is apt to lose another to the floating sea gull that lazily swims about the "table" looking for an unguarded piece of food. After finishing lunch, the otter rolls over a few times and scrubs itself on the head and neck with its paws.

To date, there is no record of sea otters being kept alive in captivity for more than a few days. Perhaps with better knowledge of their specialized food habits it may become possible. But the attempt must be regarded pessimistically until proved otherwise by careful experimentation. Meanwhile, we shall have to content ourselves with the reports that issue from the scientific custodians of this fabulous little animal.

▼ A STUDY IN COMFORT: a sea otter floating on its back and kicking itself along with one foot—its forepaws complacently resting on its chest. The chest also serves as a dinner table

U. S. Fish and Wildlife Service photo by Robert D. Jones, Jr.

A Shaggy Tree

▲ THE SHAGBARK HICKORY

By Dorothy Freas

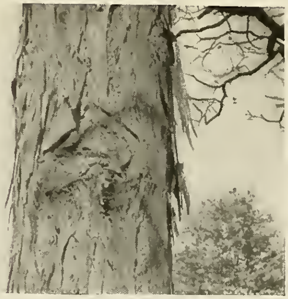
Looking up the trunk of the tree, it seems to be losing some sort of shingles. Ten-inch pieces of bark are flapping in places, but next year, when you see it again, the same sections will be hanging loosely, giving this shaggy appearance. Hence its name, Shagbark Hickory (*Carya ovata*).

It is a tall tree, about 80 feet high, with a slender trunk. The branches come out at sharp angles and are smooth and gray.

In the spring, it grows light green flowers. By summer, there are waving branches of compound leaves (usually five), but all the squirrels and small boys wait for autumn when the large leathery nuts fall. Although hard to get to, the kernel is amply rewarding.

The wood of this tree has commercial value. It is a long-wearing lumber, good for ax handles and wagon wheels, where toughness is necessary.

▲ THE LARGE leathery nuts attract squirrels and small boys in the fall



▼ THE BARK flaps like loose shingles in the wind

THE FIRST ASCENT OF EL SANGAY

Continued from page 221

ma herrani. The mossy outside of the nest, in a niche twenty feet above the stream, was soaked like a sponge and dripped water continuously. Neverthless, the interior was dry. Two weeks later the owner was still working on it! The perseverence of these birds through weeks of storm was beyond human comprehension. That this feathered electron, splashed with the fire of the tropics, should choose as an abode a barren, water-soaked wilderness of ash left the mentality of luxury-craving humans in complete coma.

Not 100 feet away on the same bluff was the nest of a still rarer hummingbird, the Black-throated Bronze-tail, *Metallura williami atrigularis* Salvin. Its home, too, had never before been found. Two other nests were discovered in the paja grass in the same valley, one of them beside a large rock in the stream.

The place where three rivers came together, the Indians called "Tres Aguas." The outlook here was not auspicious. We were facing the Rio Negro. In its angry waters disaster lurked. The previous evening the Alao peons had refused to build an adequate *chozo,* or lean-to of grass. They huddled all night and arose wet and disgruntled. The "waterproof" covers of our sleeping bags leaked like sieves. Films and cartridges were wet. The drenched wood could not be coaxed into flame. We ate cold meals. We were in a cul-de-sac between mountain walls and could see nothing but fog and mist. Even the two faithful Quechuas were discouraged.

On the twenty-fourth, Waddell and Lewis arrived with six sullen peons. On the twenty-fifth, I gave orders to cross the river. The peons revolted. They pointed with fear at the rising El Negro and protested that, if we crossed, the daily rains would swell it to frightful proportions and prevent return. While I attempted to dispel the leader's fears, the rest of the peons slipped through the grass and fled over the mountain. They took our remaining venison. Terry and Waddell chased them in vain. For three days we waited—and watched food supplies diminish. Waddell went to Alao, sleeping in the snow on a high mountain range without adequate covering, and returned with new peons and a cheering letter from my wife. Meanwhile the rains continued. Dryness was no longer an exact state—only a comparison with something more water-soaked. The encouraging letter and the lucky kill of a deer[5] by the leader helped us to carry on and essay the Negro.

The fording of the river was accomplished without injury or loss of equipment, and the fears of the peons subsided temporarily. We climbed to the mountaintops again.

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[5] This species, of which we took several skins to the States, proved to be *Odocoileus columbicus consul,* a very rare animal. Dr. Wilfred H. Osgood of the Chicago Natural History Museum advised that there was at the time only one specimen in the museums of the world—a female in Stockholm, Sweden.

Following a watershed that gave uncertain footing on its jagged edges, we came to a jutting escarpment, which we called Desolation View. No one could exaggerate the ghastly panorama that filled the enormous basin below us. It was the Grand Canyon all over again but done in blacks and livid grays and filled with a spectral atmosphere. We continued along the knife-edge for the rest of the day. At times it was only two feet wide, with yawning chasms on each side. Late in the afternoon it opened out into a wide plateau, more than 13,000 feet in altitude and covered with endless paja and a few stunted trees. The leaves and trunks resembled pear trees, but the yellow flowers reminded one of flat-topped goldenrods. On the eastern escarpment of the plateau, Lewis located dilapidated chozos made of grass. These may have been the remnants of Dyott's Windy Ridge Camp, the last trace of his route that we encountered. The peons called it "Carniceria" (the Meat Market), because of the tapirs available. This is probably not the "Carniceria" of G. Edward Lewis' article in *National Geographic* Magazine, January 1950, page 134.

The next morning Terry took the peons back to Tres Aguas to bring up the rest of the supplies. So diminished was their number that double trips had to be made each time camp was moved. Terry's feet were now badly infected, but with characteristic disregard of self he made the return trip in one day.

From Windy Ridge to his Cinder Gap Camp, Commander Dyott tried two routes, one along the plateau, the other into the Labyrinth. Of the latter, he said, "A worse one could not have been chosen!" As our peons also refused to follow the plateau, Lewis undertook a reconnaissance into the Labyrinth with the only Indian who still claimed to know Dyott's route. They lost themselves in its intricacies, and the Indian finally admitted ignorance of Dyott's course. But the killing of a deer and a rare tapir, *Tapirus roulini*, revived our waning courage.

That night we witnessed an awe-inspiring vision. As we stood on the brink of the escarpment, the filmy curtains of the Shroud rolled back. Gradually the mysterious God of the Snows was disrobed before our eyes. Drape after drape slipped away and dissolved. The disrobing began from the base upward. First the great flanking buttresses of ash and lava took form; next the lower edges of the snow fields, where irregular tongues of white forked into the gouged sides; finally the icy shoulders shook themselves free, and the perfect cone came out against a methyl blue sky. Save for a singular black spot near the apex, the mighty head was perfect—a sublime and majestic being who might have come to Earth from chaotic mountains of the Moon to take part in creation of abysses and chasms as strange as those of our satellite—abysses that now were taking on grotesque shapes in the palpitating gulf at our feet. As we gazed, a huge billowing cloud of pure gold swept in from the "Oriente" and, half circling the mountain, passed off to the south. To the east the sky assumed a violet light, while to the west cloud masses, already dulled by approaching night, leaped up in pink foam. Night brought the usual deluge and biting temperatures.

In the morning the peons refused to move. They were tired and wanted to feast on tapir and deer. Neither arguments nor offers moved them. Their only answer was, "Mañana!" I feared desertion, so during the day they were kept under surveillance.

Personally, I spent the night listening for sounds from the chozos. Another defection would spell failure. With fatigue and the accumulated pain of hardship and frustration heavy upon us, this was in some ways the darkest moment of our expedition.

(*In the next issue of* NATURAL HISTORY, *the author will tell of the remaining episodes in the first successful attempt to scale El Sangay.*)

HOAX OR FAIR WARNING *Continued from page 227*

first glance. Of course, a mimic must never become so numerous or conspicuous that its potential enemies can easily "catch on." The value of mimicry would be destroyed if many of the mimics could be eaten before the creature preying on them tackled the dangerous or unpalatable model.

Unfortunately, a great deal of uncritical writing has been published on mimicry among butterflies without clear evidence that the model is less desirable as food than the mimic. The similarity in coloration between the Viceroy Butterfly (*Basilarchia*) and the Monarch (*Danaüs*) has been pointed out repeatedly without a good case being made for any relationship beyond coincidence. The range of the two is different. They do not fly in a similar manner or frequent the same areas to any appreciable extent. The viceroy is regularly smaller than most monarch butterflies. Yet little has been done to settle the argument one way or the other. The butterflies must be studied under natural conditions—in the open, while they are alive and free. The question cannot be settled in an armchair between bookcase and butterfly collection. The best evidence that has come to the authors' attention was provided by an inquisitive ornithologist who tasted both of these butterflies to find out. He didn't like either, but then he was a bird watcher and not a bird. And in this country no one has gone to much trouble to show how many or how few birds catch significant numbers of butterflies and which of the insects are most usual prey. The problem is far from settled. A biting ant or a stinging wasp, a poisonous snake or a scented skunk, provide conclusive evidence in far shorter time. There is no end to the experiments and observations that the naturalist can make in this field of inquiry, and it is a study that has a close bearing on some important aspects of evolution.

ANIMALS OF THE AVALANCHE

Continued from page 214

Winter comes quickly on the high mountain slopes and covers the area with several feet of snow. This leaves only three months that are at all mild, and into this short time is squeezed what we know as spring, summer, and fall. Snowstorms in midsummer are not too unusual, and the temperature nightly drops below freezing.

Winter turns the high mountains into an abandoned wilderness of snow. Most animals either migrate or hibernate to escape the icy blasts. The rosy finches, which normally feed among the summer snow fields, move down into the valleys, and elk herds migrate as much as 50 miles in order to reach mild winter range. The snowshoe rabbit turns white and uses the big snowshoes on his feet to move over the surface of the snow and feed on protruding plants.

Marmots are undoubtedly the laziest members of the alpine clan. They spend about three-fourths of their lives in a hibernating sleep. There is little time between when they emerge in May or June and when they must again begin storing great layers of fat for the big sleep. The callos don't spend quite as much time hibernating as the marmots, nor do they sleep as soundly. It is quite possible that they awake at intervals to munch on food stores.

The cony has devised by far the cleverest method of meeting the winter conditions. In late summer it very industriously gathers food for the winter. Cutting a bundle of grasses almost as big as its body, the cony shoves these crosswise into its mouth and then bounds back to the "hay barn." This is a flat space that has been chosen because it is dry and airy and because there is a jutting rock overhead for shelter from rain and snow—an ideal choice from the standpoint of farming science. Each day a new layer of freshly cut fodder is added to the hay pile, and by the time the first snows arrive the cony has about a bushel of greens that have slowly cured into the most edible hay imaginable. The cony's careful treatment preserves the natural colors of the plants and their fresh fragrance.

What a life of ease the pika has arranged for himself! When several feet of snow pile up on top of his rockslide, most enemies are shut out for the winter. The blanket of snow keeps him protected from temperatures that may drop to 50 below zero in the bleak outerworld. In complete comfort Mister Cony can then relax in his easy chair of soft grass and slowly munch on his larder of well-cured hay.

He exemplifies this group of alpine adventurers who have chosen to live among the talus slides. In an area of extremes in wind, temperature, and storms, they have found protection and a comfortable existence in the rock castles.

MUSEUM ANNOUCEMENTS

Rare Butterflies and Moths

A select sample from what is believed to be the finest and most colorful private collection of moths and butterflies in the world will be on public display at the American Museum until May 11. The exhibit, entitled "Velvet Wings," contains some of the outstanding specimens from the late Mr. Frank Johnson's famous collection, recently acquired by the Museum.

Among the specimens are moths with nearly completely transparent wings—scaled only along the edges—and others with large "windows" in each wing. Other unusual species have tails six inches long from the outer margins of the hind wings. Outstanding among the butterfly groups are those whose wings change color with the reflection of light, from a brilliant blue to black or from a vivid green to tan or white. Represented in the collection are many of the most beautifully colored and patterned butterflies known to exist.

The collection, which recently arrived at the Museum, brings to some 300,000 the number of insects donated by Mr. Johnson to the Museum. Though primarily a businessman, Mr. Johnson's hobby had developed so that he was both a collector and purchaser of insects. He financed several scientists to arrange and prepare reports on particular groups of insects. In addition to aiding collectors in Peru, Brazil, Colombia, Ecuador, Argentina, Guatemala, Mexico, and the West Indies, he sent out numerous expeditions in quest of unusual specimens.

"Oscarette"

Plans for the fifth annual national contest for the best school-made motion picture film have been announced. The contest is sponsored by the American Museum's Service Center in connection with the annual Audio-Visual Aids Institute programs.

The competition is open to all students of junior and senior high schools in the United States. The films must be 16 mm., planned and produced entirely by the pupils, and must not exceed 100 feet in length. A school may submit more than one entry but will not receive more than a single award a year. To enter the competition, the faculty adviser of the group of student movie-makers must secure an entry blank from the Museum, fill it out, and return it on or before June 15, 1950. The film must be sent to the Museum Service Center by December 1, 1950.

The selection of the winning film will be made by a panel of judges. In the event that five films come up to the standards of the Museum, an "Award of Merit" will be given for each of the films accorded second, third, fourth, and fifth places. Last year's "Oscar" was awarded to "Animal Antics," produced by students of George Washington High School, New York, N. Y.

The Planetarium Show

During May, "Our Battle-scarred Earth," a discussion of recent theories, will provide one of the most thought-provoking demonstrations the Planetarium has ever offered.

Other

Special Exhibits at the American Museum

May 4—May 14

Hobby Show for Older People
Sponsored by the
Welfare Council of New York City
Knitting, sewing, jewelry-making,
painting, etc.

May 6—June 4

Ceremonies of the Southwest
Lithographs by Ira Moskowitz

May 16—June 16

Second Annual Exhibition of
The New York Entomological
Society

June NATURAL HISTORY *1950*

Exploring the Desert of Death • Cherished Wildernes

Glen Canyon • Ben East: The Kettledrum Choir of Jun

New Field Books

Postage 8¢ on each book

How to Know the WILD FLOWERS by Alfred Stefferud
Birds' Nests A Field Guide by RICHARD HEADSTROM
This book shows you how to match the nest you find with the bird that built it
Includes over three hundred birds of the United States ranging west to the Great Plains
Beginner's Guide to SEASHORE LIFE
Leon A. Hausman
Beginner's Guide to FRESH-WATER LIFE
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HOW TO KNOW THE WILDFLOWERS — $2.00

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As an introduction to the fascinating world of wildflowers, this book will delight readers from eight to eighty. 140 illustrations by Sidney H. Horn.

BIRDS NESTS, A FIELD GUIDE — $2.75

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This book shows you how to match the nest you find with the bird that built it, and includes over 300 birds of the United States ranging west to the Great Plains.

BEGINNER'S GUIDE TO SEASHORE LIFE — $2.00

by Leon A. Hausman

This handy little volume describes over 250 of the most common forms of animal life found on the east and west coasts of the U.S. and Canada. Sponges, corals, jellyfish, anemones, crustaceans, mollusks, worms, starfishes, sea urchins, etc., are all included. Much valuable information is given on their habits, locations, and color. Over 250 black-and-white illustrations. 128 pages.

BEGINNER'S GUIDE TO FRESH-WATER LIFE — $2.00

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by Roy Waldo Miner

A comprehensive field guide to invertebrate marine animals usually found along the seashore from high to low tide marks and in the shallow seas to the hundred-fathom line. The range covered includes the Atlantic coast from Nova Scotia to Cape Hatteras. Most of the species, including marine protozoa, sponges, coelenterates, annulates, mollusks, echinoderms, and even the lower chordate animals, and other groups, are pictured and described. A book for the layman as well as for the student and research worker. Superbly illustrated with 24 color plates and over 200 line cuts covering approximately 1300 species. This classic has been 20 years in preparation. (For publication July, 1950. Probable price: $6.00).

SHELL COLLECTOR'S HANDBOOK — $4.00

by A. Hyatt Verrill

An invaluable guide for the beginner, the amateur conchologist, and those who want to make sea shells a hobby. It fills a long-felt want among shell collectors by describing the strange ways of shells, their lives and habits, how they are formed, where they live, how and where to search for shells, and how to prepare and classify them. Descriptions of a great many of the more widely known shells from all parts of the world with their Latin and English names are given, together with a simplified method for their classification and identification. Over 100 line drawings and photographs. Approx. 256 pages. 5⅜ x 8.

FIELD BOOK OF NATURE ACTIVITIES — $3.95

by William Hillcourt

This is an indispensable companion volume to each of the other Putnam Nature Field Books. It is also outstanding in itself. It gives a broad outline of all the exciting possibilities within each field of nature study and provides a wealth of ideas for getting the greatest amount of enjoyment out of a nature hobby. There are more than 500 specific suggestions for projects—things to do and things to know—in the field of nature. It is extensively illustrated with numerous drawings and diagrams and is written by the National Director of Scoutcraft of the Boy Scouts of America.

The BOOK SHOP

THE AMERICAN MUSEUM OF NATURAL HISTORY
77th STREET AND CENTRAL PARK WEST, NEW YORK 24, N. Y.

LETTERS

Sea Moth

SIRS:

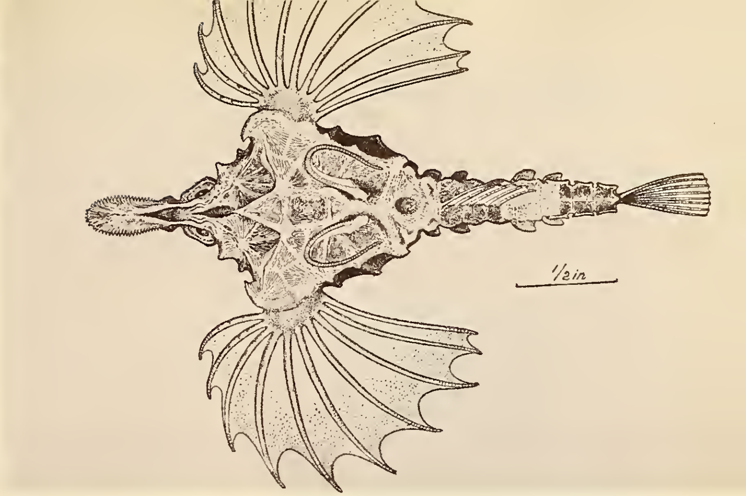
. . . Can you give me the scientific name and distribution of a fish that I know only as "Pegasus"? Despite its name, it is no kin to the sea horse but rather a sort of "boxfish." Specimens occasionally reach this country, dried, in collections of oriental insects, for in this state the fish is sometimes mistaken for a large locust! I understand that it is quite fragile in life and that it spends most of its time at the surface of the water, close to floating masses of kelp . . . The one specimen I have seen was in the private collection of a well-known museum curator, who, for some reason, does not seem willing to give me any further information on the fish. How rare it actually may be, I do not know, but I have been in correspondence with Mme. du Breuil of the Hong Kong Biological Society in the hope that she may be able to obtain a dried specimen for me. Could you give me a little information that might aid this good lady in securing one?

HENRY A. NICHOLS.

Costa Mesa, Calif.

Mr. John T. Nichols, Curator of Fishes at the American Museum, offers the following information:

It is my impression that the dried specimens referred to come from Japan. In this case, they are probably the Japanese species, *Pegasus umitengu,* which is depicted here from a drawing in Jordan's *Fishes.* *



from *Jordan's* Fishes

▲ PEGASUS UMITENGU, also known as sea moth. (Viewed from below)

The Pegasidae are a family of peculiar little fishes, rarely exceeding four inches in length. They are found in oriental seas, often drifting with the currents. They are also known as dragonfishes or sea moths. Their relationship to other fishes is very uncertain. Different authors have thought them to be related to such unlike fishes as the sculpin, stickleback, and sea horse.

Big Fungus

SIRS:

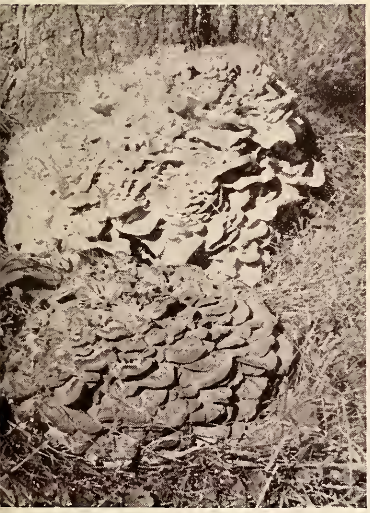
The gourmet rhapsodizes over a steak smothered in mushrooms; but recently a squirrel hunter brought me a large edible mushroom that was capable of smothering quite a few large steaks. I confessed to Mr. Martin Fuhrer, who brought it to the house, that the growth was a strange vegetable to me. Reference to Graham's *Mushrooms of the Great Lakes Region* revealed that it was *Polyporus frondosus,* a large edible fungus that is related to the woody brackets found so commonly on standing or fallen trees. It usually grows on the roots of living trees, and it causes a disease known as "spongy butt rot." Infected trees are deprived of a part of their anchorage and are susceptible to wind-throw.

Our specimen weighed fifteen pounds on the bathroom scales. It was roughly hemispherical in shape, 38 cm. (15 inches) high, and the long axis of the base measured 60 cm. (24 inches). I believe we can say that this specimen reached a very respectable size, because authorities (Lowe: *Bull. N. Y. State Coll. Forestry,* Tech. Publ. 60, p. 38) state that this species may reach a diameter of 50 cm. It grew from the ground on a central stem which branched repeatedly until more than 50 large pilei or caps formed a thickly imbricated roof over the whole structure.

Because of its enormous size, I decided to photograph it next to the trunk of an oak under simulated natural circumstances. A burr oak was convenient. Much to my surprise an eight-pound specimen of *P. frondosus* was growing under this very tree, so I photographed both together. The smaller specimen in front is still attached to its buried wood; the large specimen fitted nicely between it and the trunk of the large oak. Even the smaller mushroom measured well over a foot in diameter, the maximum size reported by Graham. The smaller specimen was cut in two, and the halves were photographed to show the branches that support the imbricated roof.

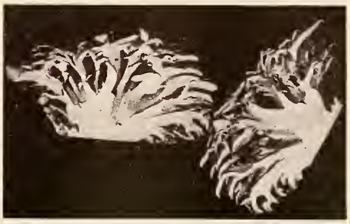
PAUL D. HARWOOD.

Ashland, O.



◄ FIFTEEN POUNDS of edible fungus (upper specimen)

▼ CROSS SECTION of the smaller mushroom



Was He a Genius Among Birds?

SIRS:

The bobolink is one of my favorite singers. No feathered songster of field or forest expresses more fully his joy of living.

On a Maine farm some years ago, one of them made me wonder if there are individual birds with exceptional intelligence and perhaps some creative ability.

---

* D. Appleton and Co., 1925.

One dewy morning I was driving the cows down the lane just as the sun was rising. From bush, tall reed, and fence post the bobolinks were telling the world of their joy in the beautiful morning. Suddenly I heard something new, something added to their standard song. I had heard their song so often that I knew every liquid note, and this new song was an amazing innovation.

Looking around, I soon spotted the singer. Down the lane between two fence posts the top board had been placed on its side. Strutting slowly back and forth on this dewy platform was an unusually large male bobolink. With wings slightly spread, he was singing the novel song. Never did Caruso strut the stage and send out his glorious voice more proudly than did this feathered virtuoso. I listened while he sang his song over and over; to the usual song of bobolinks he had added another verse. The cadence was the same, but it differed from the regular song.

Morning after morning I listened for this song, but I never heard it again. Is it possible that occasionally there is an exceptional bird with creative ability?

Sarasota, Fla. Frank E. Watts.

The following comments are offered by Dr. John T. Zimmer, Curator of the Department of Birds at the American Museum:

It is very doubtful if any creative ability can be ascribed to this bobolink. Although most individuals of a given species in any region have very similar songs, there are numerous variations due to a number of causes, and it is sometimes possible to identify particular birds by their performance.

The ability to sing is an inherited trait, and to a certain extent, the character and limitations of the song are also inherited. The conformation of the syrinx and its musculature govern much of this ability, but within certain limits variation is possible. Development of the voice is somewhat a matter of growth as it is in humans, and a young cockerel, for example, is not so accomplished a performer as an old bird whose voice may have served as a model. At the other extreme, there are a few species whose young are vocal while the adults are voiceless. Canaries have been reared where they could hear only the songs of another species, and they acquired the song of their unwitting tutors instead of that of their parents. How much of a bird's song is inherited and how much acquired is still a question. Different species may be taught to whistle quite unbirdlike tunes.

Mimicry is undoubtedly widespread among birds. Quite frequently some individual bird will interpolate a few notes from the song of another species or even some extraneous sounds; but it is not always possible to recognize what is being imitated. A still different type of variation may occur when the syrinx is malformed or injured.

In addition to various "call notes," some species have more than one type of song, including, perhaps, an elaborate flight song, and portions of these could, conceivably, be added sometimes to the common production. As far as I know, however, the bobolink has but the one type of song.

Bird song must have evolved from some simpler ancestral utterances, and it may still go on developing into something more elaborate and finished. If evolution is to proceed, some individuals must sometime excel their fellows. The song of a species, in any case, occasionally varies in different parts of its range, but the differences are demonstrated by the general population and not by individuals.

We come back again to our bobolink. Perhaps not all bobolinks would be capable of a similar performance, but that the bird in question was deliberately "composing" is beyond any possibility supported by biological data.

Who Killed Those Robins?

Sirs:

A pair of robins built a nest in a crotch of one of our elms, and we could look down into the nest from one of our upper windows. In time we saw two baby robins in the nest. When they were not quite half grown, a mysterious tragedy befell them. We saw them in the nest at twilight, and a little later the mother bird was brooding them. In the morning the nest was empty. Upon investigating, we found the two little birds dead on the ground about ten feet from the tree where the nest was. They had not been bitten or mangled in any way.

We thought at first that an owl might have taken the mother bird and that she might have dragged the young out in her struggle. To our surprise, however, we soon saw the mother and father robin gathering dried grass and carrying it to a neighboring tree, where they were busily building a new nest.

Do parent birds, obeying some strange instinct of their own, ever destroy their young?

Carlotta E. Long.

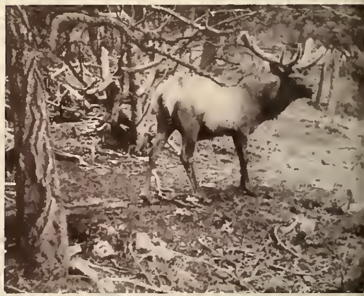
Caledonia, N. Y.

The following information is offered by Dr. John T. Zimmer of the American Museum's Bird Department:

Accusations are sometimes leveled against wild birds for supposedly killing their own young, but I know of no authentic instance of it. Young ones may be severely pecked by other than their parents when they intrude in a family gathering, as in the case of barnyard fowls and other terrestrial species. But these attacks are usually not severe enough to cause the death of the intruder, and they could hardly occur among arboreal birds. Stories of parents carrying poisonous berries to feed their young when the latter have been caught and caged are beyond credence.

When young birds die in the nest, the family life of the survivors goes on unchecked, and when the dead youngsters fail to respond to the parents' efforts to feed them, they apparently cease to be recognized as offspring and may eventually be removed with other debris in the parents' routine procedure of cleaning the nest. Even when all the young have succumbed, the old birds are likely to continue efforts to feed them for at least a short time before they abandon the nest. If early enough in the season, a new attempt to rear a family may be made, otherwise not.

What killed the young robins in the nest you describe is problematical. It is hardly likely that a brooding parent left the nest so precipitously as to have dragged out both young. It is far more probable that the birds had been left without parental protection for some unknown reason during a chilly night and succumbed to exposure. They were found in the morning quite dead but without sign of injury, and the chances are that they had died in the nest some time before they were removed by the old birds. In any case, there is no reason to suppose that they had been killed by their parents.



Bull Elk

Sirs:

This picture of a bull elk with horns in the velvet was taken last June. I first knew of the elk's presence when I was walking down a small hill that leveled off into a secluded park. The elk was lying down, and the horns were all that were visible at first. Going closer as cautiously as I could, I took a picture when he first got up. Then, by keeping trees between myself and the elk, he let me approach his clearing, and I was able to get two more pictures at about fifteen feet as he stood and posed for me. However, he appeared to be getting

Continued on page 288

NATURAL HISTORY

The Magazine of the American Museum of Natural History

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JUNE, 1950

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The Cover This Month

Looking out from this month's cover is handsome Chief John Hunter of the Sarsi Indian Tribe, Alberta, Canada. Every summer, after participating in the famous "stampede" and rodeo at Calgary, the Indians move their tepees west to the Canadian Rockies resort town of Banff, where Jack Breed snapped this portrait. There the Indians put on their own show—the Banff Indian Days Celebration. Tribal feathers and finery replace the Indians' workaday dungarees, and all members of the tribe attending come forth in their brightest war paint.

The Sarsi Indian group, numbering a little over 200 members, is one of several small tribes living in western Canada. Descended from Athabascan stock, like our own Navajo and Apache, they live on a protected reservation a few miles southwest of Calgary, where they engage in farming and act as guides for hunting, fishing, and survey parties. John Hunter is one of the best known of the Sarsi and one of the most modern.

The photograph was taken on 2¼-inch Anscocolor film at 1/50th second, stop F5.6.

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YOUR NEW BOOKS

Sun in the Sky • Rio Grande • U.S.S.R.

Native Arts • Out of the Earth • Narcotics

SUN IN THE SKY

- - - - by Walter Collins O'Kane

University of Oklahoma Press, $4.00
261 pp., 91 photos, 4 maps

THE Hopi Indians of northeastern Arizona have long attracted anthropologists and writers alike, and the literature dealing with this conservative Pueblo tribe is very extensive indeed. Yet the descriptions of various aspects of Hopi culture are widely scattered in technical monographs and professional journals, most of them forbidding and inaccessible to the layman. Mr. O'Kane—who, surprisingly enough, is an entomologist—has thus performed a very real service in making available for the average reader a well-rounded, popular portrayal of the Hopi way of life.

Although the book is not addressed to a professional audience, it is obviously an honest, firsthand account, based in large part upon the author's residence in Hopi villages and his personal contacts with the Indians. As such it cannot be ignored by anthropologists; in fact, it contains some material that seems entirely new. Indeed, the treatment of Hopi manufacturers is in some respects more complete and systematic than that found in the technical literature.

A nice balance is maintained throughout between Hopi culture as it exists today and the ancient traditional patterns, now gradually disappearing. It is only natural, however, that in attempting to deal with the totality of Hopi culture, the author should delineate certain aspects more successfully than others. Generally speaking, the chapters on economic life and material culture receive more adequate treatment than those concerned with social and political organization.

The presentation is simple, straightforward, and unpretentious; yet, it leaves the reader with an appreciation of contemporary Hopi life, as well as of the traditional roots extending back into the pre-Columbian past. Although not all of the illustrations are noteworthy as photographs, they do depict some subjects that have not, to the reviewer's knowledge, been illustrated previously. It is to be regretted, however, that the author did not provide a more adequate bibliography.

H. T. Tschopik, Jr.

OUT OF THE EARTH

- - - - - - - - by Louis Bromfield

Harper & Brothers, $4.00
305 pp., 32 illusts.

THE science of agriculture and the art of farming are slowly fusing into a practice of husbandry that gives hope for a more productive world. This process of fusion has been accelerating in recent years, and many isolated investigations and scattered judgments are being integrated with new meanings. Louis Bromfield in *Out of the Earth* has brought many of these developments into a focus, that of the practical farmer dealing with the realities of his land, the growth of his animals, and the productivity of his crops, whose synthesis is, broadly, better living.

Nearly all of the chapters are completed discussions within themselves, possibly because many of them appeared as separate articles in journals and had to stand alone. Thus there are many ideas, statements, and phrases that are repeated many times over; but for those of us who are likely to read the book as a whole and then study it intensively in parts, the repetition is pointed and valuable.

The book is not and is not intended to be scientific in the sense of attempting to prove effects from causes or to develop inescapable conclusions from controlled experimentation. It does, however, point up the fact that all people can be intelligent in observation, imaginative in application of experimental procedures, and sane in the evaluation of results.

The chapters on the uses of organic materials, on the extension of usable soils to subsoils, on the control and improvement of the water table, on planned farm livestock economy, and on regional opportunities in husbandry have special and intensive meanings for all whose roots are in the soil, from the backyard gardener to the extensive farmer. The rest of the book, which brings a deeper understanding of the meaning of agriculture in this modern world, should be read by all who enjoy the present one and respect the one of the future.

Charles Russell

NATURAL REGIONS OF THE U.S.S.R.

- - - - - - - - - - - - - by L. S. Berg

Translated from the Russian by O. A. Titelbaum. Edited by J. A. Morrison and C. C. Nikiforoff

The Macmillan Co., $10.00
436 pp., 81 illusts., 23 maps, 30 tables

FROM Arctic tundra to the subtropics and from land below sea level to some of the earth's highest mountains, the U.S.S.R. is one of the most varied countries. This geographic panorama has deeply influenced the characters of the peoples of the Soviet Union, and their history. It is certainly going to influence the future history of the whole world. There is, therefore, crucial importance in having available in English an authoritative and generally adequate description of the physical geography of the U.S.S.R.

This work was first published in Russian in 1936, and it is the standard treatment of the subject within Russia, itself. The author, a leading Soviet geographer, is an extremely versatile scientist, probably best known in this country as an ichthyologist. The translation is said to be scrupulously faithful to the ori-

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ginal, but it is also clear, sufficiently idiomatic, and readable in English. Special care has been devoted to the tricky problem of translating names of plants and animals. The photographic plates are not those appearing in the Russian edition but are a good selection from other sources.

Treatment is regional by zones defined climatically, topographically, and biologically. The whole vast area is divided into 20 major zones, each the subject of a chapter with systematic discussion of definition, climate, relief, soils, vegetation, and fauna, plus an occasional special heading when appropriate. Arrangement and style are those of a rather dry textbook, and the book will hardly be read for pleasure, but it is an invaluable work for reference and study.

G. G. SIMPSON

THE RIO GRANDE: RIVER OF DESTINY

- - - - - - - - - - - by Laura Gilpin

Duell, Sloan & Pearce, $6.00
243 pp., 234 photos, 5 maps

THIS is a very handsome and impressive book, magnificently illustrated and written with directness and great sensitivity. As in her earlier camera chronicles, Laura Gilpin's photographs are of exceptional quality, and they portray the landscape and the peoples of the Rio Grande Valley with imagination and drama.

The book, the author tells us, is intended as "a portrait of a river with a sequence of related subjects." That it more than succeeds in this aim is evident, but in a sense it is also a photographic record of the history of the Southwest. Like all great rivers, the Rio Grande has dominated the lives of the inhabitants of its valley from the prehistoric past to the present day. Important events in the histories first of the Indians and later of the Spanish conquistadores, colonists, and Mexicans were enacted along its banks. Still later came the Anglo-American farmers, cowmen, prospectors, and industrialists. The people and monuments of the Rio Grande Valley reflect these several racial and cultural heritages as the author's camera roams the river from its source in the San Juan Mountains to its delta on the Gulf of Mexico.

The contents are divided into three principal sections, entitled respectively "The Source," "Midstream," and "The Border." In addition, a useful appendix includes a glossary, chronology, bibliography, and miscellaneous statistics concerning the river. The accompanying text supplements the photographic essay, highlighting the outstanding events of Southwestern history as these unfolded down the length and breadth of the Rio Grande Valley.

Although, perhaps, the point is not driven home with sufficient emphasis, Miss Gilpin's pictorial record reveals all too clearly the progressive desiccation of the Rio Grande as the great river approaches its delta, and points to the urgent need for additional and more stringent conservation measures.

H. T. TSCHOPIK, JR.

FLIGHT FROM REALITY

- - - - - - - - by Norman Taylor

Duell, Sloan & Pearce, $3.50
237 pp.

ALL "slaves of habit," whether it be of coffee, tea, tobacco, or tequilla, should understand and appreciate the title of this book. For here we have a general and lively account of some of the world's most interesting plants—chiefly those producing narcotics. The sort of "escapism" that these plants, through their alkaloids, may aid is best conjured up by some of the chapter headings: "The Pleasant Assassin," "The Abyss of Divine Enjoyment," "Come and Expel the Green Pain," "The Lively Image and Pattern of Hell."

The reader may meet old acquaintances in this volume like the ones mentioned above; in addition, appear a galaxy of unusual and largely unfamiliar botanicals including caapi and coca, kava, hashish, and peyotl. Of some of these Mr. Taylor speaks with first-hand knowledge; for the others he has digested a sizable bibliography. Of their use the author seems to agree with the Guatemalan Indian who, to explain his addiction to the alcohol of aguardiente, replied: "A man must sometime take a rest from his memory."

Some minor errors of fact have crept into this book. For example: Inca Peru included no part of Colombia but did include the northern half of Chile (p. 147); the coat-of-arms of Peru includes a llama (not a vicuña) and a cinchona tree (not a coca leaf) (p. 150); the coca shrub may attain a height of six feet, and it is very doubtful if individual cocales produce for centuries (p. 155); and there were never "ancient Caribs" in Haiti (p. 161).

W. H. HODGE

OF MEN AND MOUNTAINS

- - - - - - by William O. Douglas

Harper & Brothers, $4.00
338 pp.

THIS is a book of the out-of-doors, an account of the author's days spent in the mountains of Washington and Oregon. These sojourns in the magnificent wilderness of the Pacific Northwest begin as boyhood exploits and are continued as outings and spiritual refreshment in the busy life of a man devoted to public affairs.

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As a small child, William Douglas suffered an attack of infantile paralysis that threatened to leave him a cripple. His legs were weak, and he turned to exercise in the open as a systematic campaign to recover their use. How well this determination succeeded is amply evidenced by the rugged experiences he later had in mountain climbing. The town of Yakima, Washington, was his home for many years, and he was handy to an environment that developed him physically and induced a love and an understanding of nature. Whenever possible, he struck off into a primeval environment, and in his later years this habit brought not only an intimate first-hand knowledge of these western mountains, forests, and streams but periods of relaxation from human congestions and regimented behavior.

The reader of this book who is a lover of the out-of-doors (and that should include most of us) will find much to enjoy. There are episodes of camp life, glorious scenery, storms and sunshine, much about plant and animal life, and a great deal about trout fishing. The author is a keen observer; he is well-read in natural history, and he is on familiar terms with prominent naturalists. He makes the most of his hours with nature. He documents his piscatorial opinions with citations from Izaak

Continued on page 288

Exploring the "Deser

From the cliff statues of Bamiyan to the mysterious ghost city of Peshawarun—an expedition searching for traces of ancient man in little-known portions of Central Asia

By Walter A. Fairservis, Jr.*
Special Field Assistant,
Department of Anthropology,
American Museum of Natural History

An expedition is born of an idea, which in turn is begot from study. In this case the study was on the lands of Central Asia; the idea was that ancient man made his home there as well as on the Euphrates and Nile. The expedition took us to Afghanistan—beyond Khyber Pass—and revealed to our searching eyes the traces of mankind from the Ice Age to the days of the Crusades and the glories of the Peacock Throne. Our work took us into secluded grottoes, rich valleys of melons and grapes, and great deserts as remote from human knowledge as the planet Pluto. We saw the marks of mountain ice, great Buddhas carved in cliffs, strange signs on rock, the mound vestiges of prehistoric villages, the signs of ancient seas, ferns from the age of the dinosaurs, and a great city without a soul, mourning the past glories of Solomon and Afrasiyab.

The prosperous interior cities of Asia—Herat, Kandahar, Meshed, Ispahan—form a crescent enclosing a chain of deserts that are utterly removed from our world. Each desert has a name that explains something of the fate of the trader or soldier who ventured too far from the watered zones—the Dasht-i-Kavir ("Desert of Salt"), Dasht-i-Naumed ("Desert of Despair"), Dasht-i-Margo ("Desert of Death"), etc. Moistureless, cloudless, swept by winds of high velocity, and baked during an endless summer by temperatures many degrees above 100 F., a more severe bound and brake to human ambition is hard to imagine.

The red plateau of Registan marks

▲ Between the towering slopes of the tral Hindu Kush, the Bamiyan Valley con many interesting vestiges of earlier cult

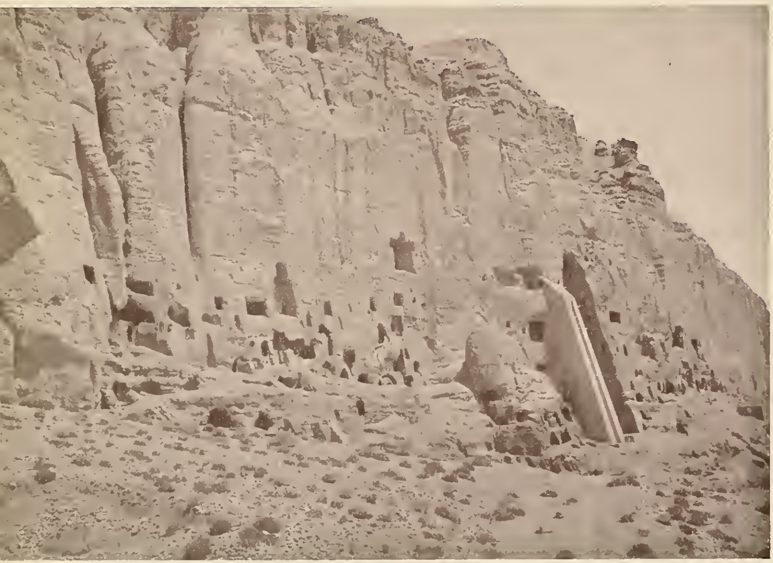

Photo by L. B. Dupree

▲ The Buddhist grottoes of Bamiyan. The people who created them were fugitives who sought refuge here from persecution in India

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*Walter A. Fairservis, Jr. is the son of Edith Yaeger (Fairservis), one-time leading lady in the theater. He has worked in archaeology in one way or another since the age of nine, when he first entered the halls of the American Museum of Natural History. Mr. Fairservis received his B.A. and M.A. from Columbia University and is at present a candidate for a Ph.D. at Harvard. While he was on military service in

Photo by Fairservis

view was taken from the fortress of Shahr-
ak, said to have been destroyed by Genghis
in the thirteenth century

f Death"

the eastern end of this haunted chain of aridity. Across it the wind blows monotonously from the west and northwest, and the air is hot and parching. Yet a river breaks into the desert chain here. The Helmand, flowing from the western branch of the Hindu Kush, cuts south between Registan and the "Desert of Death" and then turns west and north to die in the swamp of the Seistan basin, on the boundary between the Afghan and Persian deserts.

* * *

Mongolia, China, and Japan, he studied the languages of the Far East; and he recovered one of the skulls of *Homo soloensis* from the Japanese and returned it to Dr. G. H. R. von Koenigswald. Mr. Fairservis is a Special Field Assistant in the Department of Anthropology at the American Museum, and he expects to depart soon on an expedition to Central Asia to continue his archaeological research.—Ed.

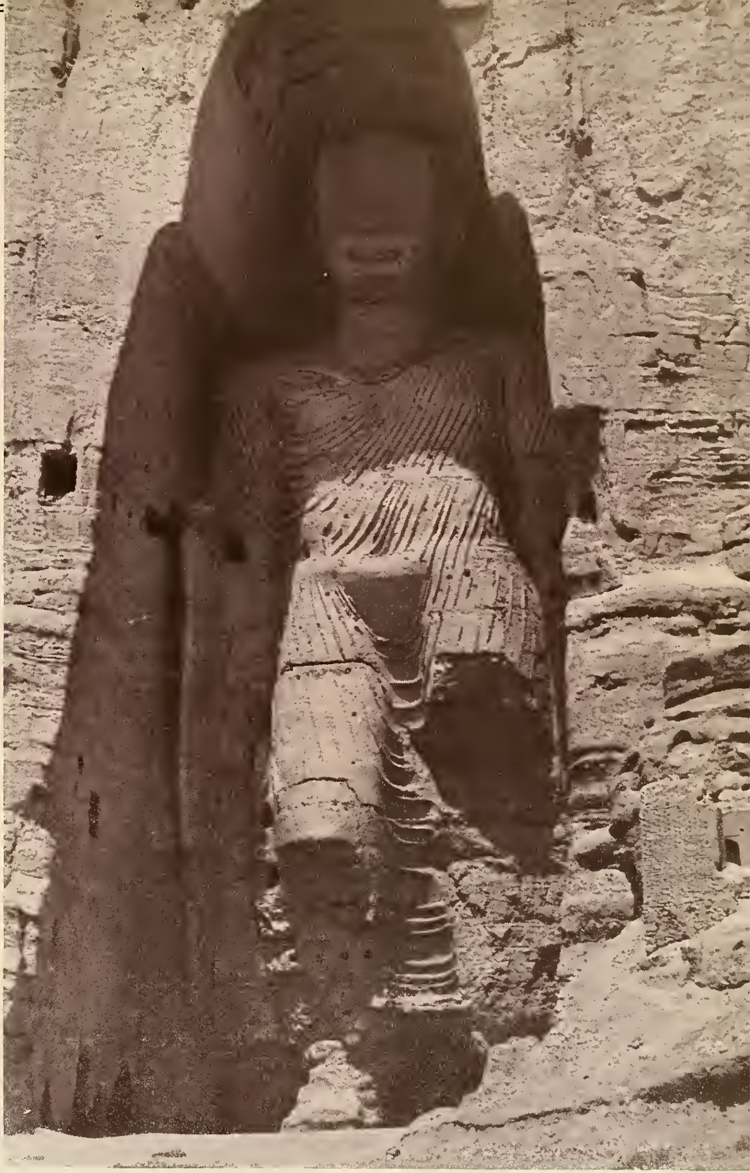


Photo by L. B. Dupree

▲ THE GREAT BUDDHA of Bamiyan: a 130-foot statue carved in the hard rock of a breccia cliff. The valley in which this and other similiar statues are found is almost 100 miles west of Khyber Pass

▼ A MEMBER of the expedition rests on the shores of the Helmand River

Photo by Fairservis

◄ The crumbling towers of an old fort stand silhouetted against the flat river bottom that has seen armies come and go. Another view from the heights of Shahr-i-Zohak in the Bamiyan Valley

Photo by Fairservis

▼ Undeciphered petrographs like these are seen along the road from Kabul to Bamiyan

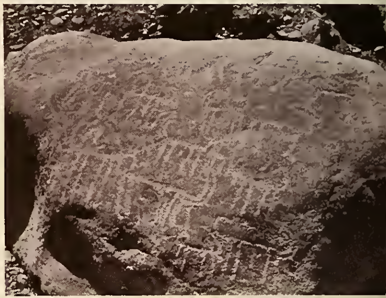
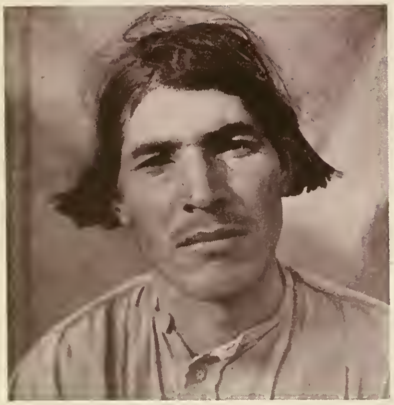


Photo by L. B. Dupree

This is a stream capable of upholding life along its narrow, fertile valley and at its mouth, the oasis—Seistan. Nile, Euphrates, Helmand—rivers like these, flowing through deserts, are the sole support for the people of vast regions that would otherwise be uninhabitable. The way in which a culture utilizes this essential resource of water determines the heights to which it can progress. We know very little of the Helmand, but in view of the cultures of India and the Near East we should know more.

It was with the intent to study this region that I approached Dr. Harry L. Shapiro of the Department of Anthropology at the American Museum of Natural History. I wanted to take a field party to southern Afghanistan to search for the sites of prehistoric man, which in theory should be there. Dr. Shapiro was in full sympathy with the program; and after a small fund had been raised, I left for Afghanistan with two companions—Louis B. Dupree, paleolithic archaeologist, and Henry Hart, surveyor. We met our equipment in Karachi, Pakistan, and began the thousand-mile journey to the north by way of Multan, Lahore, Peshawar, and the Khyber to Kabul, the capital of Afghanistan.

From the first, the expedition seemed shadowed by ill fortune. We had hardly gotten eighteen miles from Karachi when we found our way blocked by one of the monsoon-swollen branches of the Indus at its delta on the Arabian Sea. Fully four-fifths of the way across, the swirling water was knee-high. The last fifth, where the full anger of the flood was thundering its rage, it was waist-high! There was no other crossing, so the whole project hinged on our getting the vehicles through. If the equipment were swept down the river, there would be no expedition. I imagined myself wiring to Dr. Shapiro: "Expedition ended eighteen miles outside of Karachi!"



▲ An Afghan type: a hardy man over six feet tall and an excellent worker

Photos by L. B. Dupree

➤ Afghan workers relaxing in the middle of the day. They are working for an American engineering company at Kajakai, in the Middle Helmand Valley

➤ AN AFGHAN "MILTON BERLE," who, like others of his kind, was always able to restore the expedition's sense of humor

Photo by L. B. Dupree

⮟ ONE OF THE MANY mounds containing artifacts of prehistoric peoples, which the author hopes to explore further on his coming expedition

Photo by Fairservis

A motor lorry on the opposite side finally braved the flood and, with half the local population pushing, got across to us. Near by, some Pakistan farmers were trying desperately to save some cattle that were struggling in the flood. I hoped, however, that the weight of our equipment and the jeep's four-wheel drive would save the day, and so we tried. In low-low, the jeep and its trailer reached midstream, with three Americans and an English ally muttering words of encouragement as if the car were a college gridiron squad. But in midstream she stuck! Our combined efforts were useless, and for all practical purposes the First Afghan Expedition was the Last! But the local populace suddenly thrashed through the water, and wherever there was a place to push or pull, they did so. In fifteen minutes we were roaring along the desert road through the Sind on our way to Kabul.

In spite of daily tire difficulties, mechanical failures, and the monsoon, a week later we were winding along the tortuous route of Khyber Pass, about which so much has been written and so little of the real feeling conveyed. And then there was that indefinable moment of excitement when the gate at the frontier was opened and we drove into Afghanistan.

Our Western conception of the country fills it with bloodthirsty fellows who love destruction and make a career of brigandage. Yet how mistaken that conception is! We can only testify to the wonderful way we were treated on every hand. Minister of Education Aziz, though seriously ill, put every convenience at our disposal, and Mr. Ahmad Ali Kohzad, the President of the Kabul Museum, went out of his way to see that our stay was profitable. His keen interest in science was inspiring. Other high Afghan officials aided where they could. In Washington, the Afghan Ambassador, H. E. Prince Naim, was instrumental in bringing about our project, and the First Secretary, Mr. Nour A. Etemadi, was extremely understanding of our problems.

The same courteous sympathy was generally evident among the Afghan people. Proud as they are of their unconquered tradition and also filled with a not unreasonable distrust of the Westerner, they nevertheless get along very well with Americans everywhere. The Morrison-Knudsen Company, Inc., of Afghanistan, an American engineering firm under contract to the Afghan Government, has been their

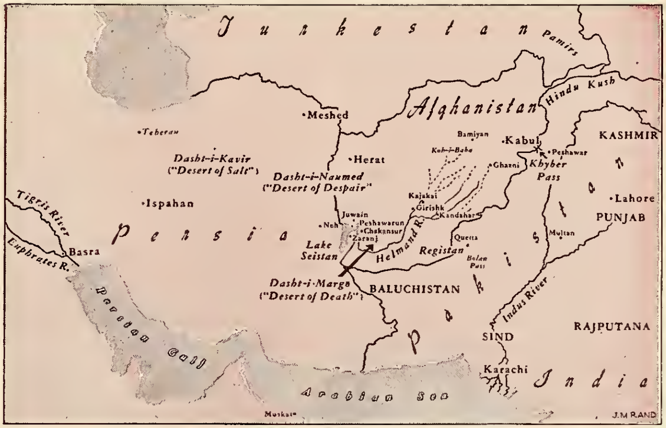

Turkestan
Pamirs
Afghanistan
Hindu Kush
Meshed
Teheran
Bamiyan
Kabul
KASHMIR
Koh-i-Baba
Peshawar
Dasht-i-Kavir ("Desert of Salt")
Herat
Ghazni
Khyber Pass
Dasht-i-Naumed ("Desert of Despair")
Tigris River
Ispahan
Kajakai
Girishk
Lahore
Juwain
Kandahar
PUNJAB
Neh
Peshawarun
Chakansur
Zaranj
Multan
Quetta
Persia
Basra
Lake Seistan
Helmand R.
Registan
Bolan Pass
Pakistan
Euphrates R.
Dasht-i-Margo ("Desert of Death")
BALUCHISTAN
Indus River
Persian Gulf
RAJPUTANA
SIND
Karachi
India
Arabian Sea
Muskat
J.M RAND

Photo by L. B. Dupree

▲ A FRIENDLY AFGHAN who found humor in everything

▲ THE VEHICLE THAT carried the expedition across 8000 miles of desert and mountain. A typical scene at Seistan, a desolate district in southwestern Afghanistan

Photos by Fairservis

▲ A CARAVAN in an Afghan village on the road to Seistan

major source of contact with Americans. Afghans are employed in the construction camps, and Americans are now no novelty in the cities. There is every chance of friction, yet cases of it are rare.

We were helped voluntarily on many occasions both by the Afghan lorry drivers and the people of the fields. Strongly Moslem as these people are, they never let religious feeling interfere with their good treatment of us. I do not mean to gloss over the Afghans with fine words as if the country were some Asian Eden. We had difficulties, of course, with thieves, malcontents, etc., but no more than we would have had in the United States. Under the country's absolute but progressive administration, Afghanistan is rapidly taking a place in the Asiatic world, which will have to be reckoned with by all nations in the scheme of world affairs.

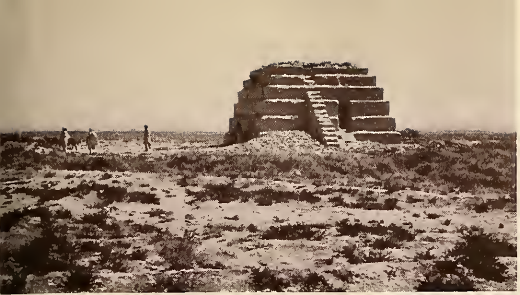
Kabul is a fast-growing city with paved streets, electric power, and plumbing. Set in a beautiful mountain valley, it is surrounded closely by high hills on which the ruins of old forts can be seen. Indications of Afghan progress are seen in the strings of lights that have been placed on these hills, ringing the city with their illumination. Approaching Kabul at night, which one usually has to do in the long drive from Peshawar or Kandahar, the glimpses of this "necklace" around Afghanistan's new "city of light" are rather breath-taking.

The peoples one encounters in Kabul clearly indicate Afghanistan's position at the crossroads of Central Asia. Mongolic Hazara, Turkic Uzbeg, Persians, and Baluchi mingle with the Kabulese. The Pathan peoples of eastern Afghanistan, who are there in large number, have been written of too often to repeat the description here, but a glimpse of their tall figure, stern face, straight nose, and piercing black eyes is sufficient to give one a hint of the spirit that has kept their mountain homes inviolate over so many centuries.

Afghanistan economy is primarily agricultural, heavily supplemented by animal husbandry. The melons and grapes of the Kandahar region are justly famous and are of high quality. The number of "fat-tailed" sheep is amazing, and it is quite ludicrous to see these unusual animals waddling hurriedly across the road with their fatty hind appendage acting as a brake to their progress. Long-haired goats mingle with the sheep, and their browns and blacks are quite striking. Camels are seen in great abundance, and no matter what the temperature or the hour, the sight of their flopping lower lip, disconsolate eyes, "cloth" ears, and rather inarticulate body restores one's sense of humor instantly.

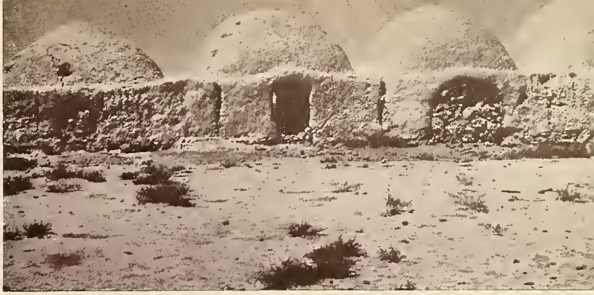
Whereas in the past Afghan agriculture has been limited to a few crops, recent emphasis on land reclamation through irrigation has instigated experimentation. The possibilities of growing a major staple crop such as cotton are very good, and a gradual revolution in Afghan economy could well take place with the irrigation of these hitherto arid lands.

After final arrangements had been made, our expedition set out for the Helmand Valley and the beginning of our intended task. The route we followed out of the mountains was a very ancient one, an alternate road to India via Ghazni, Kandahar, and ultimately the Bolan Pass of Baluchistan. However, at Kandahar we went westward toward Girishk instead of south to Quetta in Baluchistan. On the evening of our second day from Kabul we had reached the river and proceeded south on its western bank until our progress was blocked by the dunes



Photos by Fairservis

Possibly an ancient granary in Seistan. It resembles a haldean sacred tower, though it is 1000 miles distant



▲ **Beehive-shaped houses** on the Perso-Afghan frontier near Lake Seistan

and wadis of the Dasht-i-Margo.

The Helmand at Girishk is several hundred feet wide in summer but at least three times that in spring. The valley it has carved out is several miles wide in places. South of Girishk, the people live down along the flood plain, most of which is irrigated or covered with tamarisk. This flood plain abuts against the boulder-conglomerate bluffs of the desert, and we had to travel on these bluffs because of the brush and irrigation ditches on the flood plain. The high wind that blows from the west across the desert has blown out the sand of the surface, leaving only the large boulders. They are almost cemented into position by chemical and thermal action and present an exceedingly hard surface of black pebbles. This is the process known as "armoring the desert," and, in fact, it would take the best of modern equipment to crack this natural armor. Our vehicles ran smoothly over this surface at speeds up to 50 miles per hour without difficulty. Ancient erosion, however, has carved ravines, or wadis, out of the desert. The sand has found refuge in these, and each system constitutes a trap of the worst sort for the unwary driver.

Trying to get a vehicle out of one of these traps is a nightmare worthy of a Poe or a de Quincey. The wadi's walls prevent the wind from cooling one's body, and the direct rays of the sun, unbroken by clouds or haze, pour mercilessly on the men working to free the vehicle. On one occasion it took us four hours in the heat of the day to get free of an innocent-looking patch of white sand. Four-wheel drive, bracing, canvas, wood flooring, etc., were of no avail; only the combination of shoveling and ardent pushing did the trick. Being far from gasoline sources, we could not afford to skirt the many miles of wadis, so in order to stay within range of the river we were exploring we had to take certain risks in crossing them.

These ancient river systems, in carving out their pseudo basins, have left high walls and bluffs in places. As the desert horizon is usually almost mathematically level, seeing these bluffs is a definite relief. On one occasion we had with us an Afghan boy, Olam Nabi, who spoke three languages: Pushtu, Persian, and Baluchi. He had been extremely helpful, especially in gathering fresh fruit and eggs for us. As we were driving south one day, he pointed to the west where the vast expanse of the waterless waste of the "Margo" spread its heated surface. To our amazed eyes we seemed to be gazing at the walls of a great city, beyond which could be seen towers and buildings. The nearer we approached, the more our first glance was confirmed. Suddenly we all recognized the "city" for what it was—simply the bluffs of our well-known wadi-basin system. It was neither a mirage nor a trick of the mind, but our eyes, so accustomed to the monotonous horizontal, had conjured up dwellings when the horizontal was broken.

Our survey along the river confirmed the belief that this part of Central Asia had been unglaciated during the Ice Age. For this reason, it may well have been a haven for ancient man. The mountains that prevent the Indian monsoon from bringing moisture to southern Afghanistan must have performed the same function during the Ice Age, with the result that the unnourished mountain glaciers could not have devoured the lands to the south. The extent to which ancient man utilized this ice-free area is as yet uncertain, since we found no actual artifacts. However, future search of the region should confirm his traces—traces that were only hinted at in this first brief survey.

Just before our departure from Afghanistan we were told by Mr. Morris Brown, an engineer, that there was a valley near Kajakai, in the foothills of the Koh-i-Baba, whose rocky slopes were covered with strange pictures of animals and figures. We were naturally eager to visit this place. After swimming the Helmand and climbing through a break in the cliffs, we entered a narrow valley several hundred yards in length. One glance confirmed Mr. Brown's description. Not only were there numerous animal and human figures but a wealth of strange, undecipherable signs as well—checkerboards, human hands, loops and circles, and even a figure that suggested nothing other than an octopus! These were pecked out of the rock in no particular order. Many of them were exactly like those seen by the Russians in the Pamirs. We had also seen similar ones on the road to Bamiyan, the ancient center of worship in Buddhist times. As to who made these drawings, and when and why, we have no answers as yet. Petroglyphs have been cut by man in extremely remote antiquity and carried over into modern times. Many of the animal drawings were probably made to bring success in hunting. A high percentage of signs were probably used as amuletic devices or cabalistic tokens. The similarity of some of them to certain ancient alphabetical symbols may aid us in understanding these glyph-pictures, as will their relation to conventional art forms and religious symbols.

Having completed our reconnaissance along the middle Helmand, we proceeded into the Seistan region of Afghanistan, which lies along and over the frontier of Persia. We set out along the foothills of the Koh-i-Baba and headed westward. Approaching the Persian frontier, we turned south of the main route at the cool tree-studded city of Farah. The road, an old one that led from Herat into Seistan, is now used by occasional motor lorries en route to Chakansur.

We passed our first night in Seistan on a bank beside this road, where a low mud wall provided protection from the northwest wind. As we proceeded southward, the wind seemed to increase in violence until "puffs" of 60 miles per hour were a daily occurrence. This is the famed "Wind of 120 days," which starts in May and blows well into September. Velocities up to 110 miles an hour were recorded by the British on the Perso-Afghan Boundary Commission around the turn of the century, and at no time did we encounter a velocity of less than 20 miles per hour. The wind is a curse and a blessing at the same time, for the temperature of the day becomes almost unbearable, varying from 105 degrees F. to as much as 125 or 130! This makes the ground so hot that at night the thermometer rarely falls below 75 degrees. The wind, however, by drying perspiration, makes these temperatures somewhat more tolerable, even though quantities of sand are whipped up constantly and the tiny grains penetrate everything, whether it be carburetor or eye.

In spite of such discomforts, the trip into the Seistan basin was most profitable. At every hand we encountered evidences of archaeological interest. Over 35 mounds, or *tells*, were located, and surface collections were made at most of these. Our laboratory studies have since revealed pottery fragments of the prehistoric period, enabling us to date a number of sites as belonging to that period. Excavation of some of these sites is planned for the coming season, and much significant material should be recovered. Thus, our primary objective in entering Afghanistan was achieved in a way that was most gratifying.

One blazing-hot September day we were amazed to see the ruins of a large city on the horizon. It might seem impossible to encounter such a thing in the desert, but the ruins continued for nearly six and a half miles! Drawing closer, we saw the remains of palaces, mosques, and homes. The wall that had protected the city was in some places in a startling state of preservation; in others it was in complete ruin. The reader may recall having read of this "Ghost City" in the newspaper accounts of our expedition—a desert metropolis standing mute just as it had for six centuries or so since its abandonment, undisturbed except for the ravages of time.

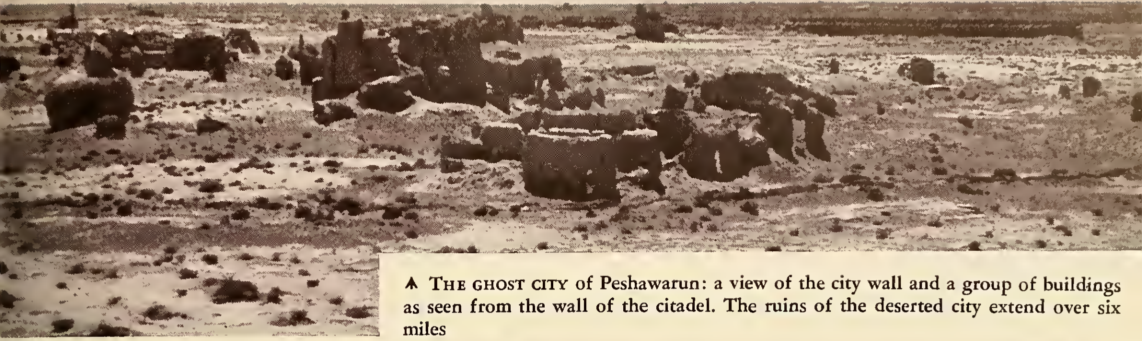
We knew from the works of Sir Frederic Goldschmidt, A. H. McMahon, Ellsworth Huntington, Sir Aurel Stein, and others that Seistan was literally covered with the ruined cities of the Medieval Islamic period (A.D. 1000-1500), as well as earlier sites. Many of these cities, such as Zaranj and Neh, were of some importance during the "Golden Age" of Islam. This one—Peshawarun—some 40 miles south of Juwain, had been mentioned in various reports but never fully described.

Our program did not permit us to devote time to Islamic studies, but we could not pull ourselves away from these ruins, so well preserved were they and so dramatically eloquent of the effects of climate on a city. Failure of the water supply seemed a logical explanation of the fairly sudden abandonment of Peshawarun. We found wells of considerable depth bone-dry.

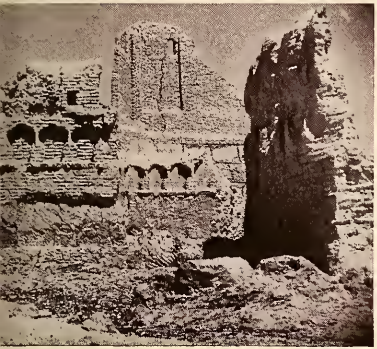
To drive between the walls of great buildings to the base of the fortress that dominated the town and to see not a living soul was an exceedingly strange experience. Everywhere there were signs of extensive irrigation, showing that the land had once been highly cultivated. In fact, from the size of the buildings and the extent of the city area there can be no doubt that Peshawarun must have been an important center and the home of a considerable population. The records we have seen tell us nothing of its history. There is a local legend that when Tamerlane punished Seistan, he destroyed the wells and thus forced the populace to flee over the deserts and mountains to found the modern city of Peshawar at the eastern head of Khyber Pass. There is no evidence either for or against the legend, but it should be recalled that a great percentage of Eastern disasters are attributed to either Genghis Khan or Tamerlane without historical confirmation.

Whatever effect Tamerlane may have had on the city, the fact remains that Peshawarun was never reoccupied. However, there is a small native village only a few miles away, where water is drawn from a well over 60 feet deep. One immediately wonders whether something caused the water table to lower so much that occupation of the city could not continue. Even if there had been conquest or plague, it is difficult to imagine a large populace giving up a fertile area completely and permanently when such areas are at a premium. I believe the answer lies in the antics of the Helmand River, which, in flowing into a shallow basin delta, changes its course at will. Movements of this sort affect the level of underground water, and thus the cause may be partly physiographic. But the Helmand shift can be due to numerous causes, and especially important may be rain failure in the Koh-i-Baba.

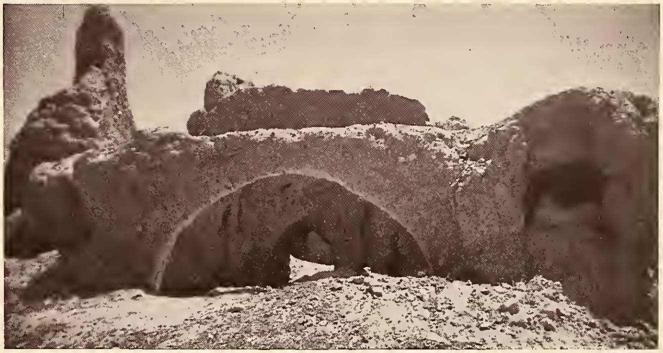
Whatever the cause of the city's abandonment, there is something pointed up in Seistan that is more significant than the story of a single city of the Islamic period. Seistan presents a forceful picture of the effects of geography on the workings of man. When nature forces



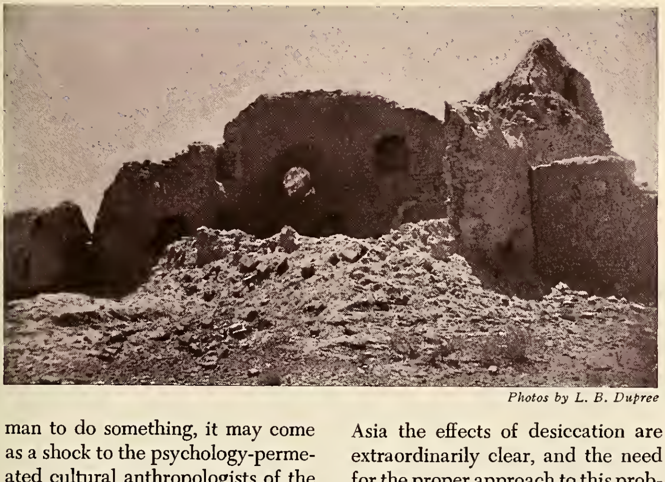
▲ The ghost city of Peshawarun: a view of the city wall and a group of buildings as seen from the wall of the citadel. The ruins of the deserted city extend over six miles



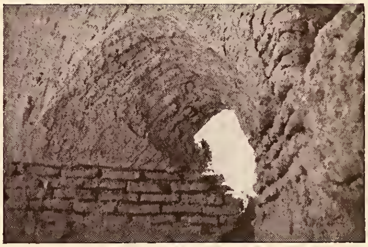
▲ Once an imperial palace, now a symbol of Peshawarun's vanished splendor



▲ When Peshawarun was a thriving desert metropolis, the sound of commerce and government echoed in these arches, now half buried



◀ Another view of the ancient palace at Peshawarun



▲ A ruined archway in the citadel wall at Peshawarun

Photos by L. B. Dupree

man to do something, it may come as a shock to the psychology-permeated cultural anthropologists of the present day, who would hitch so much to the multifaceted personality of *Homo sapiens.* Migratory studies are of vital importance if we are to perceive the workings of history as well as some of the mechanics of cultural diffusion. In Central Asia the effects of desiccation are extraordinarily clear, and the need for the proper approach to this problem of man and nature and his culture is very great. As yet, we can only guess at the factors concerned.

Central Asia forms a huge stage on which lie the clues to many aspects of mankind's ancient past. Out of its desert lands have come some of the greatest intellectual and spiritual developments in all history. Perhaps on this stage the clues to be found in lands like Afghanistan will crystallize still more for us the drama of our heritage of conscience as well as of culture.

In June we leave again for Afghanistan to search further into these unknowns.

Cherished

By canoe and snowshoe in a primeval wonderland

"BUT of all the wildernesses that you know," people say to us, "you cherish most your canoe country. *Why* do you love it most? Why have these friends you speak of been willing to give years, sometimes their entire lives, to preserve its wildness?"

I will try to answer those questions.

First, we, and many many others, love this canoe country because it is truly a solitude. It is not overrun with people as are many of the accessible wilderness areas. Instead of a few roads or trails on which you must meet all visitors, you may travel in your canoe in any direction, and yet you do not need a guide—only a good map. So you have the joy of seeing a true wilderness with utter freedom.

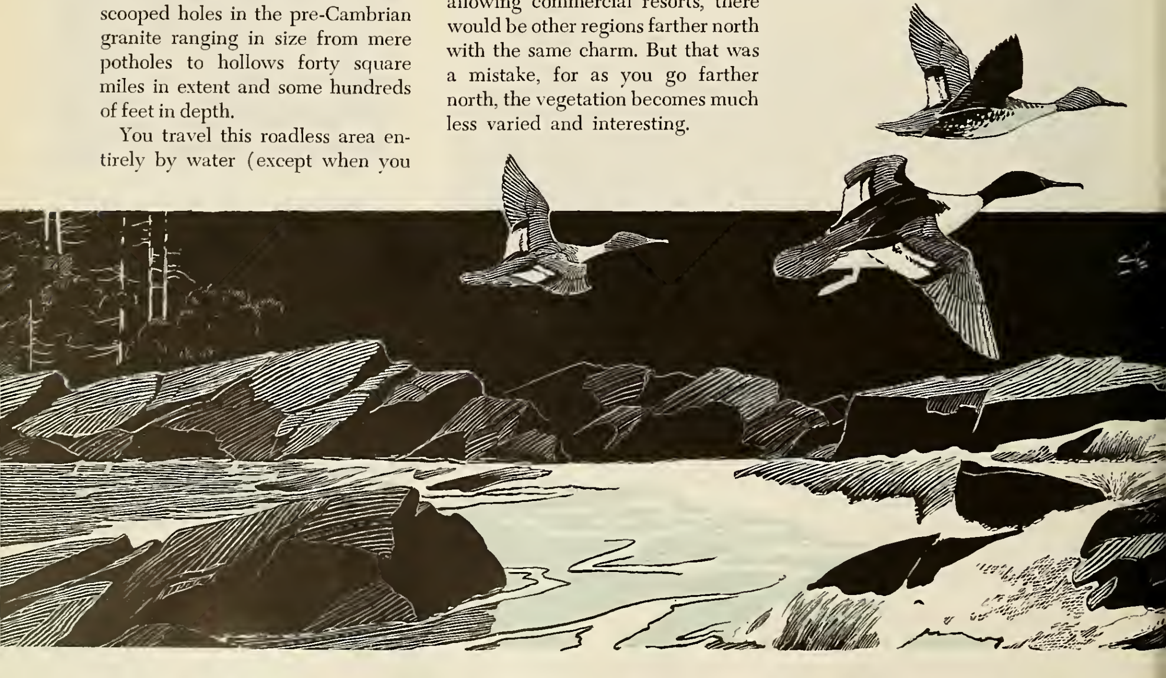
This area, the Quetico-Superior, lies on the borders of Minnesota and Ontario, between Lake Superior and the Lake of the Woods. It is hardly limited in space, being about 175 miles long and containing around 16,000 square miles. It is a maze, a labyrinth of countless lakes, tied together by rivers and channels—in fact, 40 per cent of the surface of this land is covered by water. These lakes were made in the recent Ice Age by glaciers more than a mile thick. Those mammoth bulldozers scooped holes in the pre-Cambrian granite ranging in size from mere potholes to hollows forty square miles in extent and some hundreds of feet in depth.

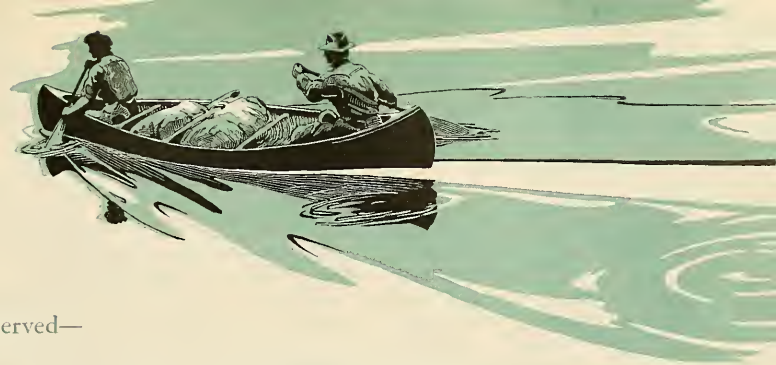
You travel this roadless area entirely by water (except when you make a portage) just as the earliest travelers did. Airplanes will soon be banned from flying over the area, to the great relief of its devotees, so that there will be no danger of finding the ancient peace shattered by a sudden onslaught of the motorized era! It is practically uninhabited, and as you journey through it, it looks as it did to the Indians and voyagers in the early days. It is possible to canoe for days without seeing other campers.

In the second place, we love the region for its sheer beauty. To enter it is to enter a forest realm of unspoiled loveliness. With lake after lake of blue lucidity, it does not matter where you choose your way, for a fresh beauty is everywhere. And such diversified beauty! I once thought that if this country were spoiled by changing water levels or allowing commercial resorts, there would be other regions farther north with the same charm. But that was a mistake, for as you go farther north, the vegetation becomes much less varied and interesting.

Here are lakes of purest clarity, streams quiet or wild with white water. Here are forests of pine, of spruce, of aspen, birch, and other hardwoods. Great granite cliffs, deep in moss and ferns, tower above, and marshes stand thick with reeds and wild rice. Here are bare, stony hills, rapids that rush by shadowed ledges, sandy beaches. Here, best of all, are hundreds and hundreds of big and little islands. Once the tops of craggy hills, they are survivors of the Ice Age—low ones of smooth-washed stone, and rocky heights black with pine.

And it is just as inspiring to the other senses, all of which seem suddenly to awaken. As you take a portage trail through the dense spruce, you are vividly, not dimly, aware of its resilience underfoot, of the scent of the pungent sweet gale leaves,





derness

nature lover will want to see preserved—

the Quetico-Superior area, whose beauty hangs in the conservation balance

By Florence Page Jaques *Illustrated by* Francis Lee Jaques*

and the poignant song of the hermit thrush, while at the end of the trail you may be refreshed by the taste of the clear water you dip from any lake or stream.

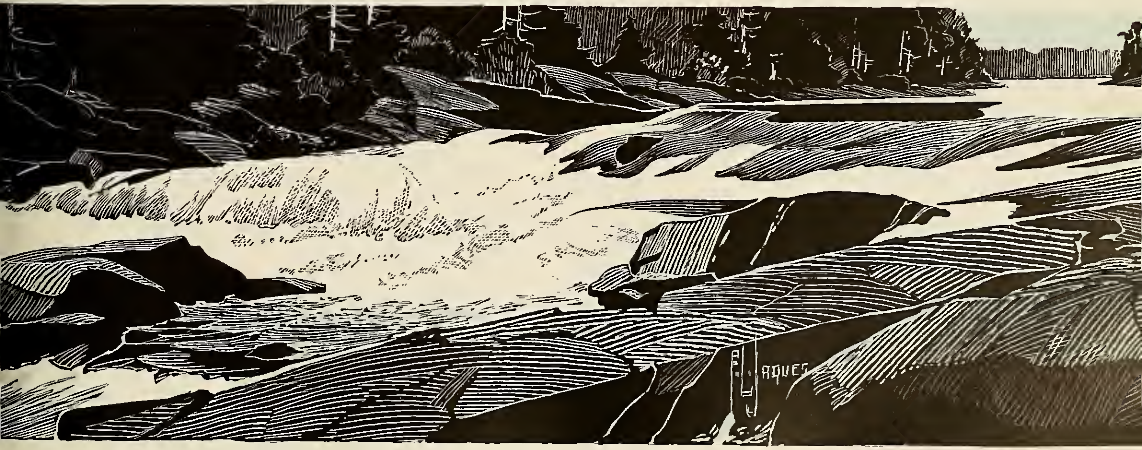
Memory brings back the smell of campfire smoke, sun-warmed pines, and damp muskeg; the taste of bass, freshly caught; the sound of a deer's whistle or the slow plunge as a moose leaves the water, and the never-forgotten loon call.

The greatest boon of all, however, is to listen to the profound silence. You cannot realize how frail most silence is until you experience this, so deep that you can trust your whole being to it, sure of its strength.

Then there is the enjoyment of physical effort. The mere breathing of the stainless, heady air; the exhilaration of paddling, drifting down glassy water or fighting furiously against a head wind. Because of the rocky terrain, making camp is seldom difficult, for there are innumerable sites to choose from. Portages are most enjoyable, if they are short ones and if you make them easy by walking across two or three times instead of lugging everything at once. The shadowy walk itself is a welcome change after the hot sun or boisterous wind over the water—if you aren't staggering under too heavy a load. Fishing is excellent in many of the lakes.

All these experiences we savor to their full because of the way we travel here. We are all dashing through the present world so fast we scarcely have time to see it. But in these primitive fastnesses all our senses have a chance to come fully into play.

I have to admit to a naive astonishment when I discovered that this country had as great beauty in winter. After our *Canoe Country* was published, the University of Minnesota Press gave us a fellowship so that we could get the material for *Snowshoe Country.* We were to stay in the same territory in the winter-



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*Florence Page and Francis Lee Jaques hardly need an introduction to the readers of Natural History, for many of their interesting and beautifully illustrated books have been reviewed in this magazine. *Birds Across the Sky*, *Canadian Spring*, and *The Geese Fly High* were written by Mrs. Jaques and illustrated by Mr. Jaques. In 1946, they were jointly the recipients of the John Burroughs Medal.

Mr. Jaques, one of the world's most distinguished bird artists, worked at The American Museum for many years, where he painted many outstanding panoramic backgrounds. He has accompanied expeditions to the Arctic, the Polynesian Islands, Panama, and the Bahamas.—Ed.

time. Because I had always dreaded cold weather, I was simply horrified at our good fortune.

I never once thought of refusing it, but I expected the worst. It was, however, one of the most rewarding experiences I ever had, and I would do it again any time I had the chance. Of course, we didn't camp; we stayed in a small cabin on the edge of the roadless area. To my surprise, a small stove made from an oil drum kept us perfectly warm indoors, blizzard or no, and I found that, dressed in layers of wool, I was more comfortable outdoors in 30-below-zero weather than I had sometimes felt on a sticky August day. I even found that in my ski suit I could rest, lying in a snowdrift, while I watched a pine grosbeak sing or a shrew dart hither and thither, and feel as much at ease as if I lay on a sand dune. For a while, at least.

And the glory all about us was unbelievable. Deep snow covers the country the entire winter. I had thought there might be a monotony about such a continually white landscape, but it was never just white. There was a continual play of color about us. The apple-green skies might reflect in the frozen lakes, or a bright sun would change the shadows on the snow to vivid blue or strong violet. Evening light might touch the snowy hills with gold and the morning with clear shell-pink or lavender. We had stormy sunsets of scarlet and purple beyond snowy pines, and we had northern lights of such strange hues I could not recognize them. Hoarfrost might be so thick upon the scraggly aspens in the morning that they looked all aflower with silver. I had thought that if the winter dragged we could always escape to Duluth for a few days; I never even remembered that idea after we were in our cabin.

The winter sounds I remember even more distinctly — the deep clangs, like those from an enormous gong, which the lake gave, and the crack of branches in the coldest weather, and the uproar the sled dogs made late at night when a wolf or a fox barked. Whenever I now hear the spring song of the chickadee—those two little notes like a miniature phoebe's—I think of a warm January day on the Gunflint Trail. And there is the faint *shushh* when a drift of snow slips from the laden branches of a spruce. I sometimes put myself to sleep remembering the nights when we walked on snowshoes along the trail before we went to bed; there would be that *shushh,* and then a deer might bound across before us in the dim snow light and disappear in the black forest. Yes, we appreciated the country in winter, too.

But most of all, I am sure, we love the canoe country for the release it brings us from our complex modern existence. This is not an escape from reality—in fact, it is an awakening to what *is* reality. The canoe country gives us the joy that should be man's heritage.

We are released from possessions. And how exultant we feel when we arrive at this simplicity—to start off in a fragile shell (for a canoe is the most trifling barrier from nature imaginable) with all our worldly goods in a few packsacks, with no need for immense mechanisms or complicated contrivances to aid us on our way, with only sturdy paddles in our hands.

We are released from time. Imagine having no need for a watch, having no appointments or schedules. There is no hurry, for as each square mile of the many thousands is rich in interest, why rush anywhere? On the other hand, if we have a desire to wander, we do not need to wait for a train or a boat to start or a gas station to open.

Suppose we have had a lazy, rainbound day and have gone to sleep in our sleeping bags immediately after an early supper. Suppose we awake sometime long after midnight to find that a full moon is flooding the lake with brilliance and that fantastic pine shadows lie black on the shore beyond our small tent. There is nothing to prevent us from breaking camp and starting out through the night into a silvery and silent world. So silent that we not only do not talk but put our paddles into the shining water with meticulous care. The moon leads us on, pines stand jet-black in mysterious ranks on either shore. What eyes are looking at us from those inky depths? Far off we hear the hooting of a great horned owl.

We come to a moonlit river, where white stones gleam in faintly rippled water and bulrushes look as if they had been dipped in quicksilver. Something slips away down the water, leaving a sharp-drawn wake. Then we come to a density of overhanging branches where the night lurks blackest.

As we emerge into another wide lake, there is a hint of dawn in the eastern sky, and we watch as the faint rose light gradually gains victory over the silver. We hear a single whitethroat, then silence and darkness again. After an interval, a loon laughing wildly somewhere down the lake brings the true dawn. We find that we are ravenously hungry and stop on an island for a hearty breakfast among its jack pines.

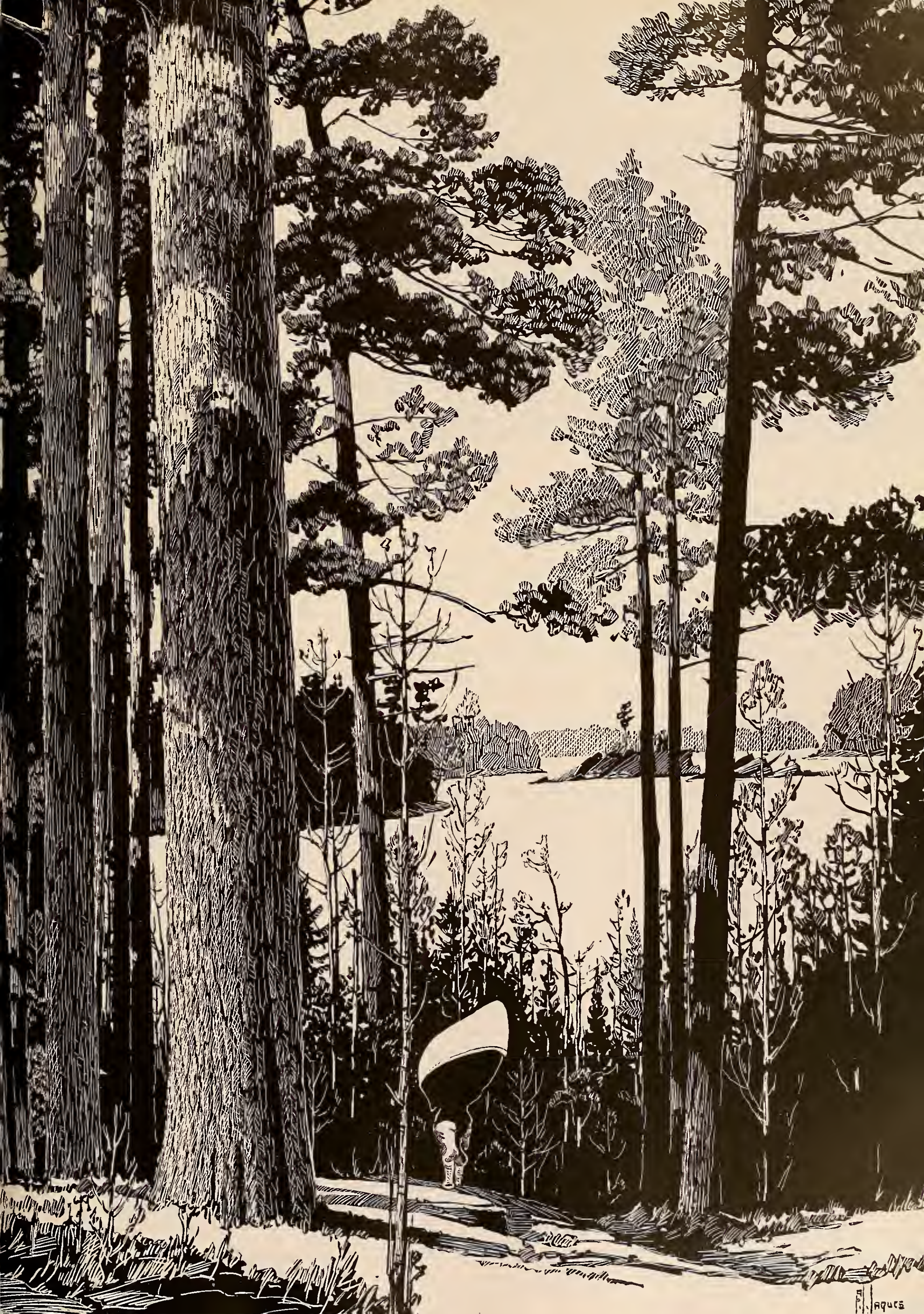
Or we may be intent on reaching a river where we hope we may find moose. But when we come to a crescent of sand beach, why not see what tracks are there? And while we're there, why not go swimming? So we do. Then we decide to fish, after which we climb on clean mats of pine needles to a hilltop for lunch and decide it is too delightful a day not to swim again, so we make camp, even if it is only early afternoon. We may spend several days there, or we may go on to the moose river early the next morning. No one minds.

We are released, too, into a wider acceptance of companionship, when, as Wordsworth says,

With an eye made quiet by the power
Of harmony and the deep power of joy,
We see into the life of things.

We discover ties of comradeship with the animals and birds, even the plants that share this region equally with us. Here they are not under tolerance. This is their land. They have as much right as we, or more, to this domain.

So when we make camp under the horizontal branches of a white pine, we feel a companionship with it. In an unexpected October storm


F. L. JAQUES

the scarlet of bunchberries through the snow has seemed as warm a welcome as children might give us. And we hail the deer we encounter, the flocks of young mergansers, the exuberant pileated woodpecker, as long-loved friends. To my surprise, I become very fond of porcupines. Somehow a porcupine swimming is a rather touching sight, and when I see a small one eating leaves and swinging gaily in a thrashing treetop, I almost want to join him. Even more surprising is to begin to care for wood mice, who are really entrancing neighbors though they may annoy you.

I never think of being isolated here. I feel the release from the heavy weight humanity now carries, rather than loneliness. How could we be lonely? We meet new friends all the time.

Once I was lucky enough to see the purple finch giving his courtship dance. I had not known that a small songbird gave such a performance. In his vibrating intensity, he would have equaled the birds of paradise we once saw in their courtship at the zoo—if his feathers had been as long! Clad in brilliant rose, he danced up and down a small log before his ladylove. He turned about and about, with his crest high, raising his wings and quivering them so rapidly that they blurred into rosy radiance. Then he sprang into the air and sang in flight as if he were trying to be a rose-red skylark, before he returned to dance on the log once more.

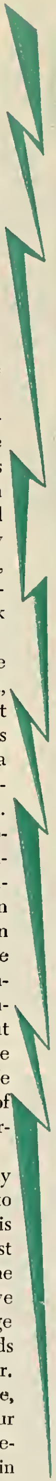
Another morning two loons permitted us to drift up to them, until we were hardly more than a paddle's length away. We were highly flattered, but we couldn't understand why such wild birds as loons would continue to let us float in company with them. We were so close we could see every detail of their black-and-white plumage, even the clear red iris of their eyes. Finally Lee spotted their nest on a hummock in the marsh close at hand, and we understood their lingering.

I treasure the memory of an autumn day when we were exploring along a shore. Golden aspens were reflected so perfectly in the dark water that we seemed enclosed in a spangled net, and I felt bewitched, as if our canoe were floating in the air in the center of this gold shimmer. To add to the strangeness, when we came round a point of rock and saw a bear facing us, it made no effort to run away as a bear should.

To look straight into the eyes of a black bear a few yards away is an odd experience. The bear gave no start of alarm and neither did we, but there was not the accord one feels with a deer in such a situation. For a moment before the deer realizes that you may be a menace, there is an inexplicable bond as its eyes encounter yours. There is no such bond with a bear! Its look changed from curiosity to disdain, and my look, if not Lee's, to apprehension, as the animal shifted feet before leisurely strolling off into the thick bushes.

Then there was the day when we had battled across a wind-tossed, white-capped lake and, tired but triumphant, came into a cove. As we floated up to shore, we saw a spotted sandpiper with her two minute babies, probably just hatched. She ran for shelter, calling peremptorily. One baby was an old-fashioned infant and obeyed mother instantly, but the other, a modern child, paid no attention to her stern command. It came out to the shore to look us over, living up to its family nickname by teetering its nonexistent tail. Such a scrap of life; but it met us on equal terms. We felt we had been congratulated on our safe arrival by a reception committee of one, and we appreciated the courtesy.

These are some of the reasons why we have such a passionate desire to see this region kept unspoiled. It is a unique treasure which we trust fervently may be preserved for the generations to come. If I could save any part of our physical heritage unchanged, it would be the woods and waters of the Quetico-Superior. For ever since I first went there, whenever I chance to think of our canoe country, an inexpressible delight and peace flood through me in a great tide.



An
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A strange cold "fire" seemed t
descend on the region, and fo
a time every bush became lum
nous beneath the lurid storm-sk

IN early September of 1949 I had occasion to drive from Madison Junction to Mammoth Hot Springs in the Yellowstone Park, and dusk was gathering when I drove onto the stretch of straight highway that parallels Swan Lake. A violent electrical storm was centered over Electric Peak, extending several miles eastward into the Beartooth Range. Heavy bolts of lightning frequently stabbed downward, and the clouds themselves seemed to be constantly flickering with an orange light. The display was so spectacular that I pulled off the road near the north end of Swan Lake and stepped out of the car to watch it.

It was then that I noticed a bluish light coming from over the low ridge to the west of Swan Lake. My first thought was of a fire, perhaps caused by lightning. I watched the ridge for a moment and was amazed to see what can best be described as a hazy patch of blue light coming over the ridge and moving down the hill slope toward the flats around the lake. It was then that I observed a very low lead-gray cloud moving swiftly above the patch of light. The patch moved through the marshy north end of Swan Lake and caused several waterfowl to rise in hurried flight.

The patch of light moved off the

Bath"

ELLOWSTONE

By
William B. Sanborn

Park Ranger Naturalist

Photo by David de L. Condon

▲ **Swan Lake**, across which the electrical display moved before passing up the valley toward Electric Peak, in the background

lake and onto the flats at a steady rate and proceeded directly toward my viewpoint. When the patch was but a few yards away, I noted a sudden calm in the air and a marked change in temperature, as well as what I believe was the odor of ozone. It was then that I realized that the display before me was some manner of static electricity, comparable perhaps to St. Elmo's fire and directly controlled by the low cloud moving above.

The patch, which actually was a static field, enveloped my immediate area. To describe the weird feeling caused by viewing the progress of this phenomenon is difficult. It kept low to the ground, actually "flowing around" everything that it came in contact with, coating it with a strange pulsating light. Each twig on the sagebrush was surrounded by a halo of light about two inches in diameter. It covered the automobile and my person but did not cover my skin. There was a marked tingling sensation in my scalp, and brushing my hair with the hand caused a snapping of tiny sparks.

The most unusual aspect of the disturbance occurred when I threw a rock along the ground in much the way that one skips a stone over a pond or lake. Every time the rock hit the ground or a piece of brush it gave the appearance of "splashing." The light would momentarily disappear from the contact spot but immediately build up again. I noted that the static could be brushed off the car surface, and it also would establish the light again in a matter of seconds. I obtained no shock from touching any object on the ground or the outside of the car.

My estimate of the speed of the disturbance was about three or four feet a second, or faster. The field seemed to be about 50 yards wide and perhaps some 250 yards in length, roughly comparable to the low cloud above.

I watched the display move quickly up the valley toward Electric Peak until it faded from view and darkness closed in. (It might be mentioned that Electric Peak derives its name from the electric storms that frequent its heights and the surrounding region. It is the highest peak in the northern part of the park.) Upon getting into the car and closing the door, I touched the horn ring and was rewarded with a most substantial shock, the effect of which caused numbness in my arm for several hours. Probably the car had become charged negatively, since it was insulated from grounding by the tires. I must have carried a positive charge from my contact with the ground and the disturbance.

When the experience was described to Ross Gunn, Director of Physical Research at the United States Weather Bureau, he commented that phenomena of this sort are reasonably common in mountainous regions during periods of thunderstorm activity. "Usually the described effects," he commented, "are short-lived and precede a lightning discharge. The glow results from ionization induced by a highly electrified cloud overhead. The electric field necessary to produce an observable glow usually exceeds 2000 volts per centimeter. It is entirely adequate to make one's hair stand on end. In the described case, the overhead cloud was doubtless millions of volts above the potential of the ground. It is a very interesting instance of this sort of occurrence because of its great length and apparent stability."

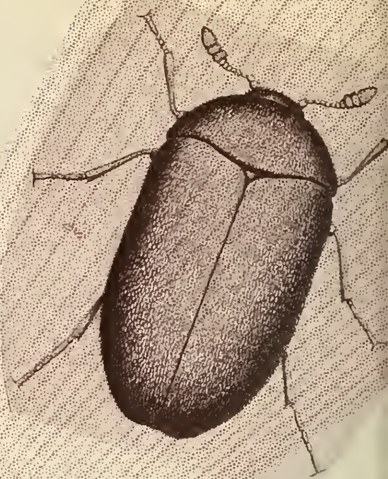
I don't know whether I would have been able to observe events as carefully as I did if I had known that it was "millions of volts," but in any case I shall certainly remember the experience for a long time as one of the most outstanding displays in nature that I have ever observed.

Carpet Beetles

Can you tell the damage they cause from that of the less destructive clothes moth? And do you know how to control their depredations? Here are the answers

By C. H. Curran

Curator, Department of Insects and Spiders, American Museum of Natural History



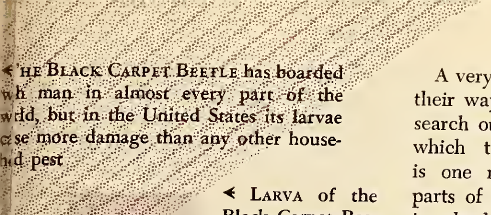
AMNH photo

▲ Spraying with a one per cent emulsion of DDT, Chlordane, or deodorized Benzinehexachloride offers good protection against carpet beetle larvae. For effective control, plan on two gallons per room, with two or three sprayings a few days apart

At almost any time during the year, but especially during the warm months, you may notice on your window sill some chunky, brightly ornamented beetles about one eighth of an inch long. If your eyesight is good and you happen to enjoy beauty in color arrangements, you will stop to admire the little creatures. If you have a magnifying glass, you will discover that the color pattern is due to the presence of tiny scales of different colors; and if you examine several beetles, you will find that the color pattern is almost the same on all of them.

Should you touch one of these beetles, it will immediately draw in its horns and legs and play dead. Often it will remain quiescent for two or three minutes and can be admired at leisure. But don't admire it too much, because it is one of the carpet beetles, and its offspring are likely to cause you anguish and perhaps a great deal of expense.

There are a number of kinds of carpet beetles, and most of them specialize in a particular type of destruction. Some prefer carpets, others like the inside of furniture, some are inveterate wanderers and chew up things in unexpected places. The larvae of all of them (and these are the things that do the damage) lurk in dark places



◄ THE BLACK CARPET BEETLE has boarded with man in almost every part of the world, but in the United States its larvae cause more damage than any other household pest

◄ LARVA of the Black Carpet Beetle (enlarged and natural size). It feeds on almost anything of animal origin, but woolens are its favorite meal

Photos courtesy Dominion Dept. of Agriculture, Ottawa

and are seldom seen—at least until they have ruined clothing, blankets, socks, furs, or almost anything made from animal matter. Even skins, hides, and many kinds of foodstuffs may be eaten. Because of their furtive tactics, they do not receive nearly so much blame as they should. Indeed, a great part of their damage is charged to clothes moths. Actually, clothes moths are relatively small fry compared with these beetles. Once a clothes moth larva begins to chew on something it stays put, but not so the carpet beetle larva. If it becomes dissatisfied with what it is eating, it will wander somewhere else, picking up choice morsels as it goes. Once established, the carpet beetle is difficult to eradicate.

The adult beetles generally like to get out-of-doors, where they can feed upon the pollen of flowers, which is apparently all they eat. Spirea is a favorite with them. Hundreds may be seen on a single bush, tumbling all over each other in their quest for food. Some of the free-flying females will find the nests of birds or rabbits, the fur of some dead animal, or the pellets of an owl. In the open, their life cycle is slowed down, so that the larvae may require two or three years to reach maturity. Apparently all except the Furniture Beetle are able to survive our coldest winters.

A very large percentage will find their way back into buildings and search out suitable materials upon which to lay their eggs. This is one reason why buildings or parts of buildings close to flowering shrubs are usually more heavily infested than others. If closed windows thwart their yearning for sunlight and food, they will get along fairly well indoors, proceeding with their family life. Fortunately, they are not particularly prolific. The offspring of a female may number from only 50 to 200, which is roughly comparable to the clothes moth but far below the productivity of most other insects.

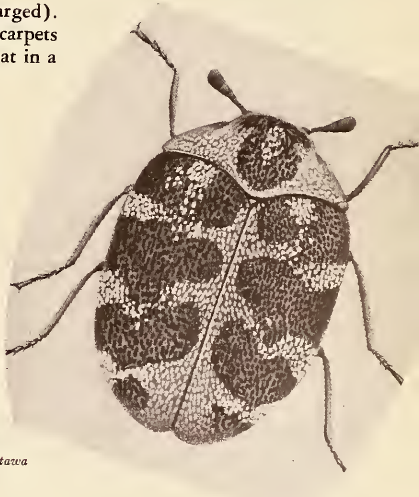
The greatest wanderer among the carpet beetles is *Attagenus piceus*, commonly known as the Black Carpet Beetle. It began its wanderings in eastern Europe and Asia and has taken up its residence with man in almost every part of the world. It was undoubtedly an unknown companion of the earliest settlers in America and probably took its toll of their meager wardrobes, but it did not receive a name until a year after George Washington became president, in 1790.

Like the early American settlers, the Black Carpet Beetle found the country much to its liking, and it prospered. The relatives it left behind in Europe have apparently continued their humdrum and unexciting lives, because they are still of minor importance as household pests. But not so the immigrants. They have kept pace with the growth of the country, and today their offspring can boast that they cause more damage than any other household pest.

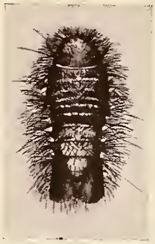
They are rather general feeders. You might find the larvae living in the sparrow's nest outside your window or feeding upon milady's choicest silks. They feed no more enjoyably upon a mink coat than upon one that is a mixture of wool and cotton. Feather pillows intrigue them and so do woolen socks. They will eat dried soups and powdered milk, and anything containing yeast will attract them. They relish dried insects and dried plants. They will only occasionally devour white cotton goods, especially if they contain starch. They'll eat almost anything of animal origin, but woolens are their favorite food.

Extensive and serious damage may result in various ways. In a large and exclusive apartment house on New York's Central Park, the residents of most of the apartments facing the Park complained of damage by the beetles. In some cases it was stated that the larvae crawled over the beds, and one tenant claimed that two or three could be found each day between the sheet and mattress of the bed in which she normally slept. After a few such experiences, she could no longer endure the thought that

➤ THE BUFFALO CARPET BEETLE (enlarged). Its larvae favor furs, woolens, and carpets and have been known to ruin a fur coat in a single season



▼ THE LARVA of the Buffalo Carpet Beetle (enlarged and natural size). Once it has found a good feeding place, it is apt to settle down there and reach out in all directions in search of food



Photos courtesy Dominion Dept. of Agriculture, Ottawa

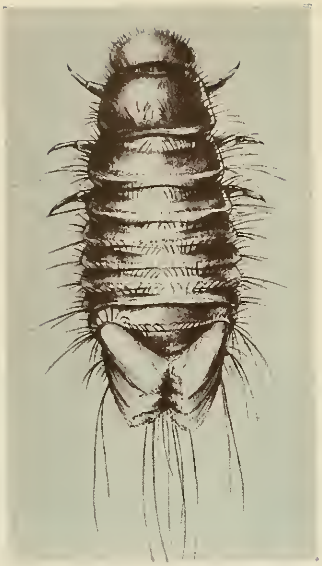


Photo courtesy Dominion Dept. of Agriculture, Ottawa

▲ **THE LARVA of the Varied Carpet Beetle is not too common or too destructive in the home, but its preference for dried insects makes it the chief pest in museums. (Photo much enlarged)**

the ugly little worms might crawl over her, and, moreover, she was afraid they might carry some disease. The tenants were certain that the larvae and beetles were entering the apartments from the hallways. In this case, it was not so.

An examination of the infested apartments and hallways quickly clarified the situation. The heaviest infestations occurred between the fourth and ninth floors. In practically every apartment examined, dark closets and dark sections of the rooms showed a light to moderate infestation. In a few closets, larvae were fairly abundant in cracks in the floor and under packages and other stored materials. They had not gone far into the halls. They had entered the apartments through the windows as healthy adult beetles. The Park was their outdoor feeding ground. They had mated there, and the females returned to human habitations in order to find food for their offspring.

An entirely different situation occurred in an apartment in the borough of Queens. This was a much older building, and the hall carpeting had been in place for many years. Large stretches of it along the walls had been honeycombed by the feeding larvae. Since the larvae wander freely, it was only natural that they had found their way into apartments. It was not uncommon to observe a half dozen of them in a single hour slithering away beneath a closed door or heading for concealment under rugs. Many of them had found their way into closets to feed upon winter clothing and blankets.

Even a building or apartment that has been vacant for two or three years may house a huge population of this pest, if there is adequate food. Usually the buildings have been left in an infested condition. In the lint in floor and wall cracks and behind baseboards, there may be plenty of food to maintain a thriving host of larvae for many years. Their presence is easily detected in such a case by the scores of dead adults on window sills and upon the floor beneath, where they have died in an attempt to reach the outer world.

One of the most serious infestations that has come to my attention occurred in a factory building used for the manufacture of dried soups. The building had been vacant for a considerable time, and there was no indication that pests were present. But in late spring adult beetles began to appear in alarming numbers. I was unable to determine what had been processed there previously, but it was certainly something that appealed to the larvae. It did not take long to discover that the beetles were emerging from cracks in the floor. These were packed solidly with whatever the larvae were eating, and hundreds of holes had been chewed in the caked substance by the adults to enable them to reach the wide-open spaces. Control was complicated because there was a double wooden floor of rather rough construction.

The Black Carpet Beetle is well adapted to survival under adverse conditions. Under the most favorable conditions, with ideal temperature and an abundance of food, it may develop from egg to adult in about six months; but if the going is rough, the life cycle may require as much as three years. The normal period of development is one year.

It is the ability of the Black Carpet Beetle larva to endure hardships, together with its habit of wandering about and feeding whenever it is hungry, that makes it such a serious pest. Most carpet beetles, like clothes moths, feed within a limited area. But a single Black Carpet Beetle larva may eat in a score of places, chewing halfway through the cloth or chewing off patches of fur over a large area. The damage may pass unnoticed, but once the clothing is worn, the weakened strands quickly give way, leaving the owner to wonder why such a thing should happen.

Anthrenus scrophulariae is known in Europe as the Old Fashioned Carpet Beetle or the Common Carpet Beetle. In America it is the Buffalo Carpet Beetle or Buffalo Moth. Many Americans have the idea that it bears this name because it was first a pest in Buffalo, New York. Actually, the insect was described in Europe more than 100 years before it was found, as

▲ **THESE DAMAGED SPOTS in a piece of untreated mohair are the work of Black Carpe Beetle larvae. In a controlled experiment, th larvae were placed in the mohair and in fou months had caused this damage** an immigrant, in Massachusetts. Another, and more logical explanation for the name is that the larva is so chunky and well covered with fur that it might give the impression of a buffalo's head and shoulders. But even this explanation is evidently without foundation. Almost certainly the origin of the name is to be found in the memories of a rapidly dwindling number of Americans who lived in the days when (or shortly after) great herds of buffalo roamed the American plains. In those horse-and-buggy days, and even as late as the 1890's, almost every farmer, and untold numbers of town and city dwellers, owned a buffalo robe. It was looked upon as a necessity for winter driving. Our robe, which lasted, I am sure, until close to 1910, had two purposes. It served as a bedroom rug. In winter, we children would leap across the cold floor and land in its heavy fur, grateful for its warmth as we dressed hurriedly for breakfast--and school. At other times, when we hired a horse and cutter (sleigh), or went on hay rides, the buffalo robe went with us to keep us warm. I do not remember what happened to our robe, but it undoubtedly became old and decrepit. The "Buffalo Moths" probably helped a lot to render it useless, because such a skin provided an ideal breeding place.

Photos courtesy Collins and Aikman

LARVAE WERE PLANTED on this piece of reated mohair velvet, and at the end of a six-ear test, no damage had resulted. Carpet eetles are hardier than clothes moths and nore difficult to kill

Furs, woolens, and carpets are the favorite foods of the Buffalo Carpet Beetle, and when buffalo robes were stored for the summer they naturally became infested. Hidden in the deep, thick fur or in creases in the woolen backing of the skin, the larvae remained undisturbed during the warm part of the year, which is their growing season. I do not happen to have seen a badly infested buffalo robe, but I have seen other furs that were ruined by this pest in a single season.

The larvae prefer to work in the deep, dark fur, chewing off and eating the bases of the hairs. Once they have found a good place to feed, they are apt to settle down. At the base of fur hair, they build a little cell and reach out in all directions in search of food. They do not require too much in a single meal, and they may go for days without feeding, but by the time they have reached maturity, a quarter square inch of hair may have been chewed away at the base, and when the fur is worn or brushed, the loose hair is pulled out. In the days when coonskin coats were a mark of collegiate sophistication, I saw examples that were ruined in a single summer. One thing that helps to reduce the extent of damage by these beetles is their love for the skin itself, because the rich oils it contains sometimes cause them to feed upon the leather without eating clear through it, rather than upon the fur.

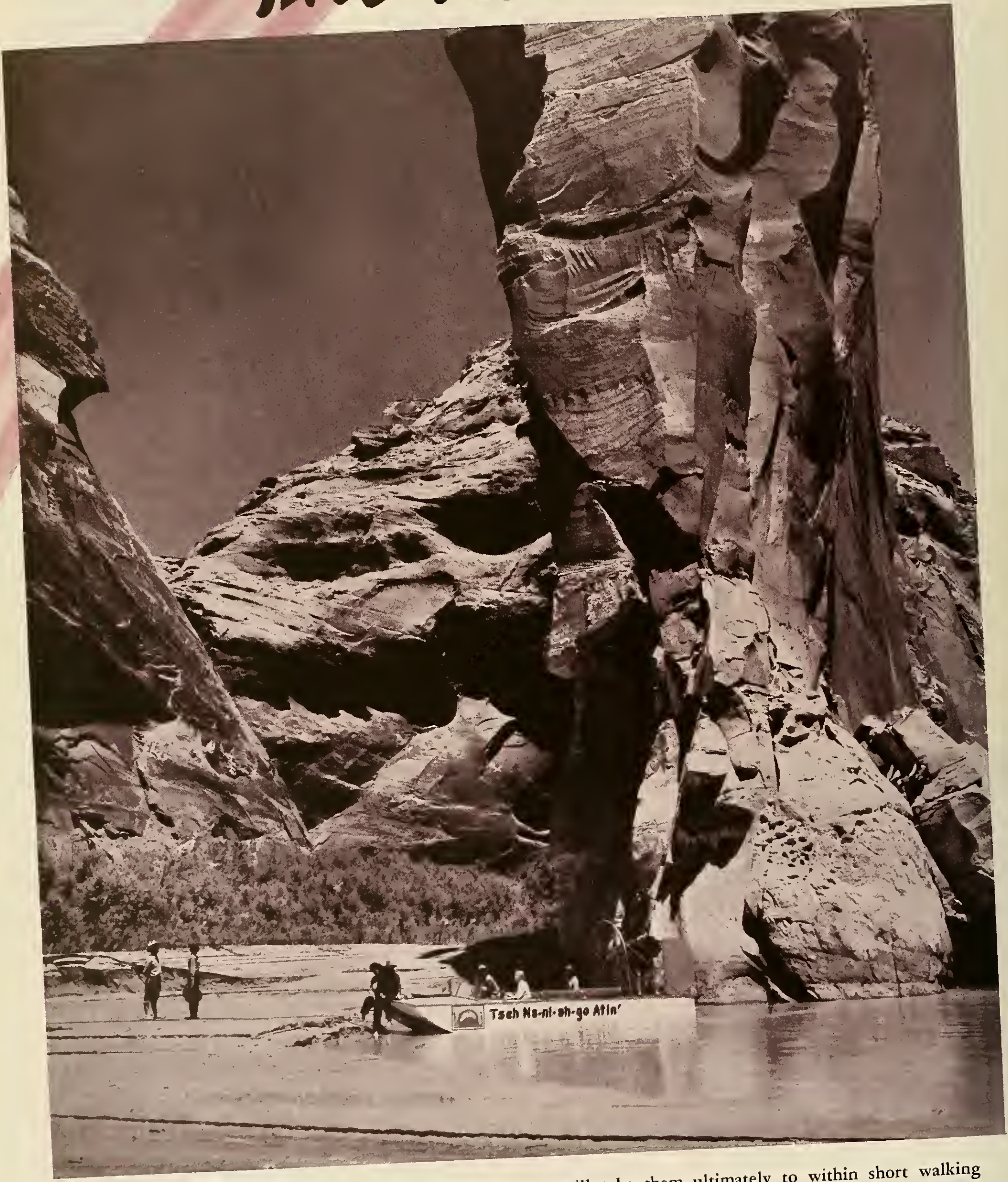
In deep and luscious woolen carpets, the damage done by this beetle may be concealed and not understood by the casual observer. Some years ago, I was called to the home of a former postmaster-general to determine the cause of damage to the living room carpet. It had been the custom to keep the shades drawn during the day, unless there were visitors. As a result, the room was in darkness, or at least very dimly lighted, for most of the 24 hours, and the Buffalo Carpet Beetle found things entirely to its liking. The broadloom carpet that stretched from wall to wall undoubtedly looked quite normal to almost everyone and was surely greatly admired by those whose feet trod upon it. But having seen such things before, it did not look beautiful to me. All around the edge of the carpet, two to five feet from the wall, were tiny mounds. Beneath each mound was the larva of a Buffalo Carpet Beetle that had chewed away the base of the warp. I explained the situation and to demonstrate pulled away the loose wool and disclosed the culprit. The party who had sought my advice (an interior decorator) was so intrigued by the "discovery" that she went about the room on hands and knees, plucking at every little elevation. She stopped only when I pointed out that if she kept it up, little of the carpet would be left.

In some parts of the country, the Buffalo Carpet Beetle is the chief pest; but it apparently does not get along too well with the Black Carpet Beetle. Where the latter occurs, the "Buffalo Moth" usually takes a back seat. In buildings heavily infested by the black variety, the "Buffalo Bug," as the larva is often called, occurs but sparingly. I suspect that the wandering habits and general feeding habits of the Black Carpet Beetle discourage not only the Buffalo Carpet Beetle but also other members of the genus *Anthrenus*. It is quite possible that the larvae of *Attagenus* will eat the eggs and young larvae of its relatives.

The Varied Carpet Beetle (*Anthrenus verbasci*) resembles the Buffalo Carpet Beetle in many respects but is much less brilliantly variegated, since it wholly lacks the reddish scales that form such conspicuous markings on the latter. It is not encountered too commonly in America, and extensive damage by it is rare. While it does like woolens, furs, feathers, and related things, it seems to prefer dried insects to all other articles of food, and it is the chief pest in museums. It shows good taste in its second preference, which is silk. The Mu-

Continued on page 282

The Rainbow Land



▲ Sentinel Rock. Passengers in the "airplane boat" pause to view this 300-foot column of rock that guards the entrance of Waweap Creek. The boat will take them ultimately to within short walking distance of the famous Rainbow Bridge, usually approached by an arduous overland route

Glen Canyon

Stories and scenes from a little-known section of our spectacular Southwest—a region now becoming accessible to the tourist who likes to venture from the beaten path

By JOYCE ROCKWOOD MUENCH

Photographs by JOSEF MUENCH

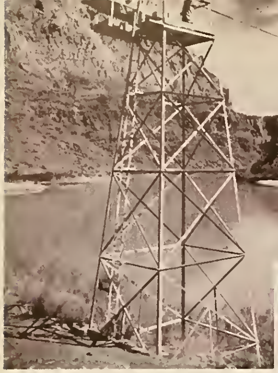
GLEN CANYON might be called the little-known parent of a famous child—the Grand Canyon. You may not have heard of it, since it has no Hoover Dam, no Grand Canyon National Park, and not a single bridge to publicize it. Glen Canyon may be almost peaceful in comparison with several of the more rambunctious offspring of this fabulous river system, but the name Glen scarcely does justice to some of the finest stone architecture in the world.

The Rainbow Land through which the Colorado River has cut its way in southern Utah and northern Arizona embraces 162 magnificent miles of winding art galleries. Burnished red sandstone cliffs hung with "tapestry," the flying buttresses of Rainbow Bridge, and the overpowering simplicity of Music Temple are within this domain. Here one also sees the staunch pillars of other stone bridges—Owachoma, Sipapu, and Augusta—the majesty of Navajo Mountain, and, of course, the sinuous, powerful Colorado, coursing silently through primeval land in the largest unsurveyed area in the United States!

Native legend has it that long ago the Indian god Tav-woats made a pathway from the balmy western land, so that an old chieftain might visit his dead wife, Nu-ma. The Indian promised never to describe the country and to cease mourning for Nu-ma on his return. To make

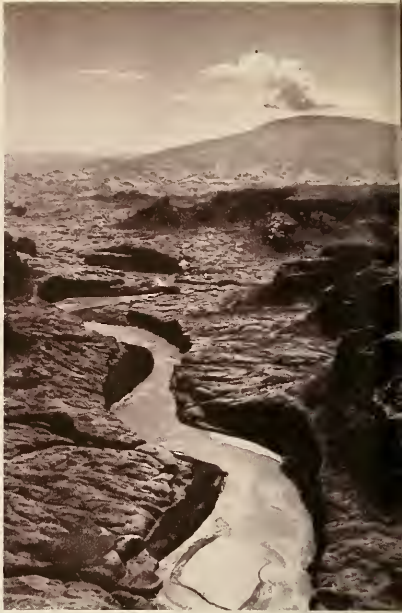
▲ THE WORK of the mighty Colorado in carving these canyons can now be conveniently studied from water level. This strangest of all river boats is driven by an airplane propeller. Passengers study the colorful cliffs at close range and camp for the night where sunset finds them

➤ EVENING IN GLEN CANYON. The boat passengers have climbed up from the river's edge to watch the setting sun paint the walls of Glen Canyon with richer hues. Most of the area they view here has not been surveyed



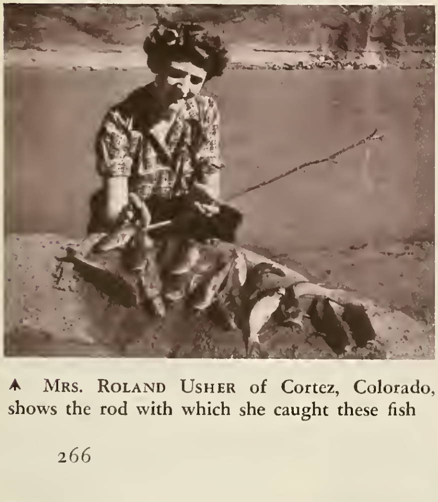
◄ **Water-gauging cable tower** at Lee's Ferry. By means of the cable car and the instrument suspended near the base of the tower in this photograph, the velocity of the Colorado River can be determined at any distance from shore. The resident engineer, Mr. Jim Klohr, is seen on the platform

► **Mr. Klohr** exhibits the delicate instrument whose revolving cups measure the velocity of the river. The 100-pound weight attached to the instrument enables velocities to be taken at various depths



◄ **Camping on the Colorado.** A fire built on a sand bar along the shores of the Colorado River in Glen Canyon makes home for the night for a party going upstream from Lee's Ferry in northern Arizona. When the fire goes out, the voice of the river will lull the travelers to sleep in their sleeping bags

▼ **Fishing for supper.** In a quiet cove, sweet-tasting catfish are easily caught for the evening meal. The boat has an Indian name meaning "Trail to Rainbow Bridge"



▲ **Mrs. Roland Usher** of Cortez, Colorado, shows the rod with which she caught these fish

Tseh Na-ni-ah-go Atin

sure that others wouldn't make the journey, Tav-woats filled the rocky trail with a thundering stream. And that, say old Indians, is how the Colorado River and its nineteen yawning gorges came into being.

White men have shared the Indian's fear of the river, spinning their own weird tales. In earlier days, people used to say that the stream dived underground and plunged over tremendous walls as it raced through a region destined to remain forever unknown!

Lest you think too lightly of Tav-woats' injunction, consider that no man has yet been able to follow the Colorado upstream through its 1360 miles of twisting rapids, and not many have descended it.

But it is high time that Glen Canyon made its debut and that it be accepted into the ranks of natural marvels. Don't expect it to offer you material wealth or hospitable lands for settlement, but be prepared to stand spellbound before its sheer grandeur.

Glen Canyon is less temperamental than most of its kin and maintains a gradual two-foot drop to the mile. The Paria River, which enters it from the Northwest, drops 7400 feet from source to mouth—an average of 43 feet to the mile. The Escalante drops 41 feet to the mile; the Last Chance, 70. Still more precipitous is Warm Creek with 90, Waweap with 100, and Rock Creek which tops them all at 285 feet downward for every mile ahead!

Rainfall is a scant nine inches in the highlands of the plateau and five inches in the lowlands, but it is delivered like a sword thrust, now here, now there, never generally. Extremes in climate, terrain, and formations are the norm. With such spasmodic rainfall, it is no wonder that the swift tributaries pour vast quantities of silt into the main river, which already has no small burden collected farther upstream. Some of this falls to the bottom to be stored until rising water can increase the

◄ An airplane view shows the rugged land through which the Colorado has cut its serpentine course. Navajo Mountain, 10,416 feet high, rises in the background

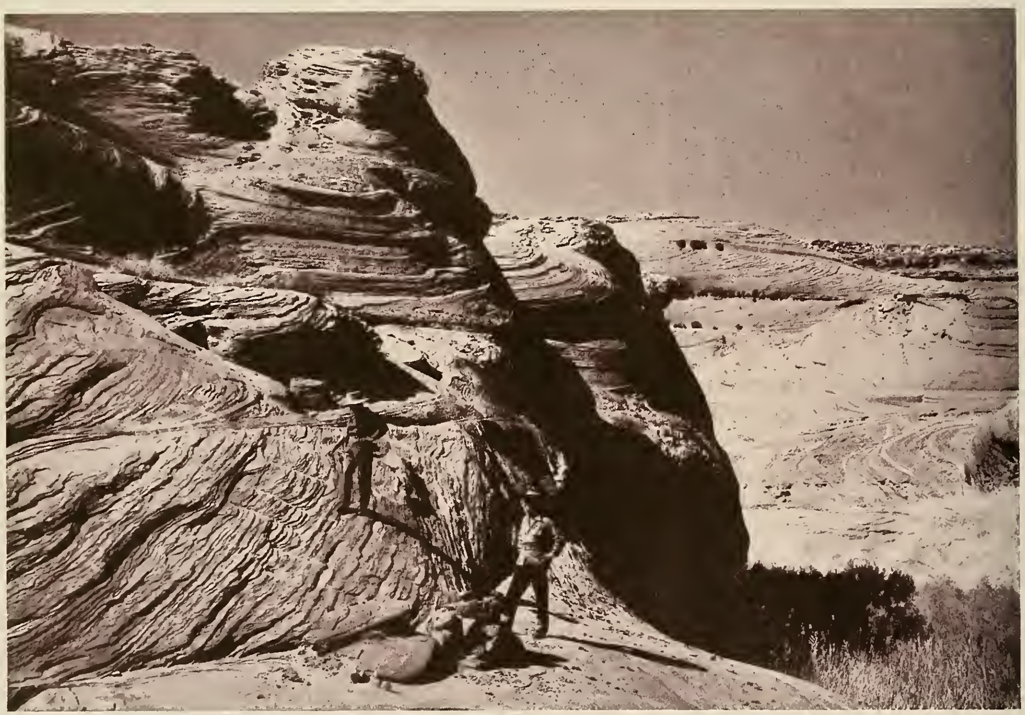
▼ For 135 miles in southern Utah and northern Arizona the Colorado River passes between the red sandstone walls of Glen Canyon. The absence of rapids enables the traveler to enjoy the spectacular rock sculpture without anxiety

carrying capacity of the river. But it will take another uplift of the land to sharpen the Colorado's cutting tools.

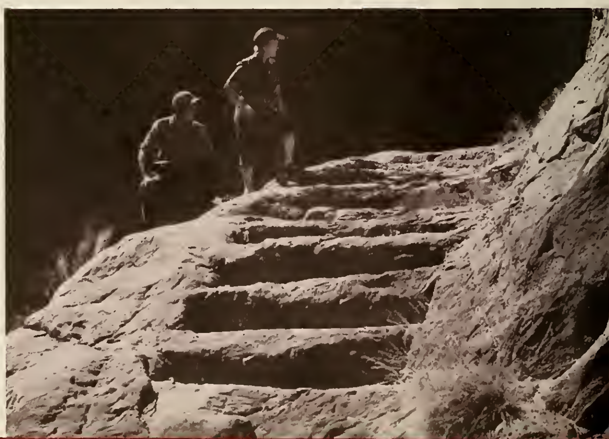
It is now possible to view the majestic rock-sculpturing of Glen Canyon from an excursion boat powered by an airplane motor. In this unusual boat, Art Greene will take you around a thousand snaky turns to reach the goal of all dreamers, Rainbow Bridge.

From the water level, the fine graining of Glen Canyon's sandstone and the elaborate cross-bedding can best be seen. But it is from a distance that the massiveness and raw color of the curving walls can best be appreciated. Here and there, it is as though a

◄ WHERE WHITE MEN first crossed the Colorado: a bronze plaque commemorating an important achievement in western exploration. Here, in 1776, a Spanish party struggled down a narrow gap to ford the river, which otherwise would have interrupted their 1600-mile journey through the wilderness



▲ HERE THE SPANISH EXPLORERS, including Father Escalante and Father Dominez, brought their horses down over the swirling sandstone to reach and cross the Colorado River in Glen Canyon. At the right, the rock drops off to a little creek leading down to the Colorado



► FARTHER UPSTREAM, pioneering history was again made at Hole-in-the-Rock. These "Mormon Steps" were cut in 1880 to enable 250 Mormon pioneers to descend a 1000-foot break in the cliff, along with 80 wagons, 200 horses, and 1000 head of cattle painter had splashed huge bands of colors to produce what are known as "tapestry walls" along these corridors of time. Nature protects them by layers of so-called "desert varnish." But every season of frost and snow prepares a layer of outworn scenics for the next downpour to wipe away, and in places great blocks of material have been neatly squared off, ready for removal to the lower reaches.

Here and there throughout the length of the Canyon, wind, water, and sand have shaped indentations from egg-cup size to gargantuan arches and embayments. Music Temple is the finest specimen of this artistry. About 500 feet in diameter and 200 feet high, its perfect acoustics carry a whisper across a clear pool and among the moss and ferns of this secret chamber, which is reached from the near-by river through a narrow gorge. Monuments stand guard like ticket takers wherever a stream comes into Glen Canyon and lead to other galleries and showrooms. Sentinel Rock at Waweap Creek is a great carved tower about 300 feet high, and Incinerary Urn at Warm Creek is a portentous and classical symbol on the Utah-Arizona border.

Some of the early explorers left their mark on this forbidding region. In 1776, a Spanish party struggled down the narrow gap to ford the river—one adventure in a 1600-mile jaunt through the wilderness. This spot, known as the Crossing of the Fathers, had been used by the Ute Indians for hundreds of years, and the Navajos continued thereafter to take advantage of it. A bronze plaque set into the sandstone commemorates the first crossing of the Colorado by white men, and faint scratches on slippery rock may have been made in that year to get Spanish forces safely down to the river's edge.

Pioneering history was also made farther upstream at Hole-in-the-Rock. In 1880, 200 men and women and 50 children descended a 1000-foot break in Glen's walls over a "road" constructed for the passage of 80 wagons, 200 horses, and 1000 cattle from Escalante to found the settlement of Bluff on the San Juan River. The feat was one that anyone, laboriously climbing up through that desolate "hole," will agree may never again be duplicated. A trace of the trail on loose slopes, some beautifully weathered steps, and a recent plaque of bronze are all that remain of what some consider the most formidable wagon trek in world history.

Lee's Ferry, too, is steeped in

▼ Rising sheer from the water's edge, the sandstone walls of Glen Canyon soar skyward. The extreme edge of the Kaiparowitz Plateau is seen across the water, above walls embroidered with fantastic designs and arches in the making. Here, in Glen Canyon, is some of the world's finest stone architecture

early western tradition. A gauging station on the bank of the river now brings new activity to the tiny fort and ferrymen's cabin that slumber in the sun. Near by, in the widening valley of the capricious Paria River, John D. Lee's early farm still produces watermelons and asparagus. A row of tiny graves in a neglected cemetery tells of tragedy that struck at the ferryman's family one summer, miles from any doctors who might have diagnosed and treated diphtheria. From 1872 until 1929, when it was outmoded by Navajo Bridge and U. S. Highway 89 (only 7 desert road miles away), the ferry made trips across the water. Every river adventure has included this spot, and it is the division line for the Upper and Lower Colorado, the zero point for measuring up and down the stream. Travel up through Glen Canyon begins here.

At Mile Sixty-eight the dark slit of Aztec Canyon beckons the visitor toward the Rainbow Bridge. A trail ascends gradually between sheer walls to what is probably the most famous natural arch in the world. Since Dr. Byron Cumming's party found it in 1909 with the aid of a Piute guide, only about 5000 white men have seen the Rainbow. Now a National Monument, it is reached by trail from Rainbow Lodge in Arizona or down the San Juan's exciting course through Utah. With a third route now possible, up the Colorado itself, thousands more will come, finding its noble proportions a fitting climax to the architectural splendor of Glen Canyon.

Still farther up, Dandy Crossing (now known as Hite) boasts the only ferry in our wonderland. It was first used as a ford in 1880, and miners pursued their forlorn hopes from it and from Lee's Ferry. Oldtimers can rattle off the names of gravel bars where homemade rockers and sluice boxes were used in the search for gold—Grub Stake, Good Hope, Olympia, California, Moki, New Year, Burro, Boston, Klondike, and Shock. Good Hope, the only patented land, was strong enough to induce promoters to bring in a water wheel. A power dredge was operated at another in 1900 but did not produce enough to pay for its installation. The California, however, brought $10,000, and it is still possible to earn daily wages from recurrent streaks on the river.

There was a renewal of mining activity in 1910 with steam dredges and power shovels freighted from Marysvale. A steamboat was set afloat to pull barges upriver to Warm Creek. Coal mined there and carried on horseback to be floated down the water was used to provide power for a gold mine on the Paria River. The first trip proved

▼ One of many regions reached only by boat. The overhanging cliffs at right bear the strains of water, while the rocks at left have been shaped like loaves of homemade bread

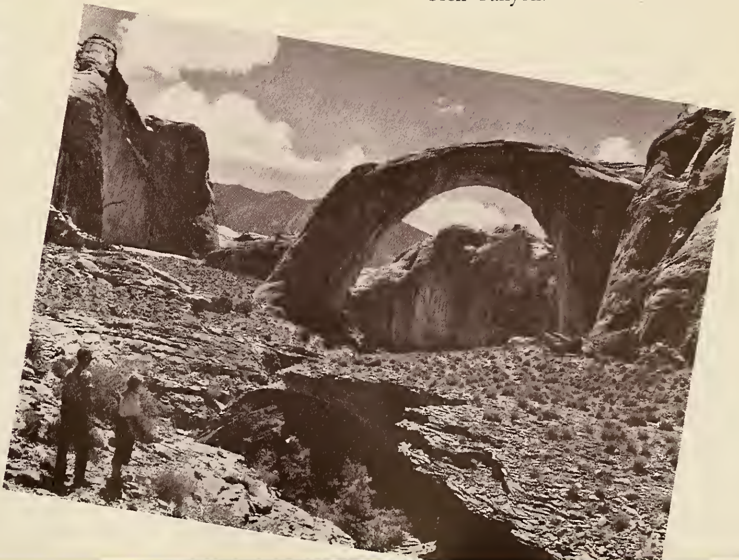
▲ BRIDGE CANYON. This cleft, with its clear stream, is named for the great Rainbow Bridge, three miles farther up. In places, the sky is almost shut out by the multicolored cliffs

that the big boiler ate up all the coal that could be dug and could scarcely hold its own against the current. At Low Water, the rusting old boiler and hull peer disconsolately above the muddy waters.

Glen Canyon and the Colorado River have not treated kindly those who would search for wealth in the ground. But they have no objection to men clambering over the rocks, delving into a hundred canyons that cry out for exploration. Hidden here are arrowheads and pottery that have long lain buried; and the limestone, interlaced between layers of sandstone, provides lush gardens of ferns and saucy-faced monkey flowers. Sand bars, changing from season to season, allow willows and cottonwoods to make shade for noon siestas, and the river is always considerate in providing driftwood for cheery campfires. It offers the delicious meat of the catfish for a nominal amount of effort. Shadowy ravines write an invitation to explorers in their unknown glens and retreating plateaus. Navajo Mountain holds its own mystery for Indian and white man. No Navajo will accompany you to its top, past War God Springs, but scientists say it is a huge laccolith—a great bulge of volcanic rock that never erupted.

The river, self-appointed curator of this canyon museum, alone knows the complete listing of the exhibits in the Rainbow Land of Glen Canyon.

➤ SWEEPING IN A MAGNIFICENT ARC to a height of 309 feet above the bed of the creek, Rainbow Bridge enjoys worldwide renown as a natural wonder, even though only a few thousand people have ever seen it. Its span is 278 feet, and the rock is 42 feet thick at the top of the arch



▲ THE ONLY INDIAN who had the courage to venture as far as the snow line on El Sangay: Manuel Olalla, a thoroughbred Quechua. He was a trained zoological collector and spoke Spanish fluently. Near by are the grass lean-tos, or *chozas*

The First Ascent of *El Sangay*

Reminiscences of a momentous expedition of 1929, when the Flaming Terror of the Andes was conquered. The adventures of four men who forced one of the world's great volcanoes to reveal its secrets

(*Concluding Installment*)

By ROBERT THOMAS MOORE
Associate in Vertebrate Zoology, California Institute of Technology

All photographs by Moore Expedition

AS I lay in my blankets listening for sounds that would indicate that our Indian porters were abandoning us, I mused on the bulky animal that had brought a touch of Africa to the Andes. It was not the common tapir of the tropics but the rare Mountain Tapir—a shaggy, black-haired, mahogany-cheeked beast, supposed to be extinct or nearly so. But strange as it may seem, it was a tiny hummingbird that captured my imagination. Once more the Fire-throat, Herran's Thornbill, had called upon us! Like a visitant from some other world, it had volplaned out of the ether and dropped on the golden clusters of our "pear tree," the only touch of color on our wind-blown eyrie. For one dazzling moment it hovered before us—took one sip of chilled nectar—and was gone!

Morning brought drenching rain. The Labyrinth was choked with clouds. But to our surprise the peons were still with us. Their leader had recovered and, miracle of miracles, was willing to proceed! We hastened to take advantage of the changed attitude, but they insisted on taking the hardest route—the Labyrinth! This had only one compensation: we could survey the bird life of the canyons and possibly find the nests of both Fire-throats, *herrani* and *stanleyi*. While we consulted, however, disaster threatened in another form. The best of our two remaining Quechuas was found in the choza, incapacitated by swollen feet. We left him to recover and follow later.

Soon we were slipping and plunging down the worst slope I have ever tried to negotiate. The rains had turned the ash into a jelly-like paste. There was no trail. With heavy loads, neither peons nor ourselves could proceed until steps were laboriously gouged into a zigzag trail. Hours followed which left a dreary memory—a kaleidoscopic vision of icy streams, raging torrents, moss-covered blocks of lava that proffered treacherous footholds, steep slopes and cliffs that were always facing us on the opposite side of streams. Dripping clumps of paja grass lacerated our hands with their saw-edges, and on the endless paramos above this sponge-like world, gnarled trees blocked our progress along knife-edges. Attempts to crawl through interstices were made with sure knowledge that one slip would mean a plunge into the gorge. And always and always there was stream after stream, torrent after torrent, and fords so numerous that definite memory of them is lost. Until—at length we reached the Rio del Volcán!

Here the peons balked. They were tired out. One poor fellow, more heavily laden than the rest, had tottered along until he had to be helped at every crossing. His leader cried out, "*No se puede ir adelante!*" He claimed we were trying to drown them and that they would "die of the cold!"

Persuasion and threats failing, we gave them the one food they wanted—our remaining bread! An added demonstration by Terry, who dashed through the swollen river and then 1000 feet up the opposite cliff, shamed them into moving on. An hour later the fords became more shallow and the water dropped to the knees. We waded for hours in a dark canyon, climbed the sheer cliff of a waterfall, followed an ash plateau beside a cinder canyon, and reached an apparent cul-de-sac, blocked by transverse ridges and deep gorges. That camp for the night we called "Sangay."

By evening the Shroud lifted once more for a moment. There, directly above our heads, gleamed the snow-white cone of El Sangay, tremulous in the failing light. It was actually near! And one of the transverse ridges turned obligingly to the southeast, heading straight for the summit. We were on the northwest slope of the volcano. Obviously the end of the Labyrinth had been reached.

We now faced the base of a cinder bluff. A hundred yards to the left was the upper end of a huge canyon of great depth, probably 3000 feet. To the right, a small arroyo carried a minor stream. Over our heads hung enormous hummocks of sullen black ash. It seemed that only a slight additional shaking from the daily rumblings of the volcano would precipitate a landslide. A mile higher, the snow began, but we did not find any evidence of the glaciers mentioned by Dyott until we reached the crevassed area on the southern slope of the cone itself.

Again the peons refused to make an adequate choza, and we knew desertion was impending. Mutterings were overhead about "El Nieve!" and "El Volcán!"—up which they feared we intended to force them. Food supplies were dangerously short. Unless the rest of the deer meat could be brought from Carniceria, we would have to reduce our diet to tea. It was decided that Waddell and I would hunt for deer on the morrow while Terry and Lewis would take the ice tent (the "fiala") and pitch it on the snow. We forestalled desertion by sending the well peons back to Carniceria, securing their promise to help Teodomiro bring back the rest of the deer and tapir. They started at sunrise, leaving behind the exhausted peon, who had nearly lost his life the previous afternoon falling from a shelf of the gorge.

The deer hunt failed, but at nightfall Terry and Lewis returned. Success had crowned their effort. The tent had been placed on the last tongue of warm ash that crept far up into the snow field at an elevation of 16,000 feet. At last we had something tangible to fight, something besides water, morass, and clouds. On the morrow we might climb out of the Labyrinth and reach clear sunlight—and ice.

On August 2, Terry, Lewis, and I, with Manuel, the last of the faithful Quechuas, took to the ridge that served as a rib of the black network supporting the white dome above us. As usual it rained, and the cone was hidden by cloud. A black knife-edge wound its way upward, disappearing in the Shroud. Rapidly it narrowed and became bare of any vestige of shrub or grass. From five feet it compressed to four, then to three, then two and one! At length, a bare six inches supported us from the chasms that yawned on either side. We seemed like tightrope walkers suspended on a slack wire in a gloomy atmosphere over depths that disappeared into unknown space. Rain slashed on our ponchos and made the ash like slimy clay. Manuel, with his heavy pack, slipped down on all fours and crept. We took turns cutting steps for our feet. At times the ash crumbled and slithered away. Landslides had serrated the edge in places and compelled dainty stepping, as if we were walking over the bodies of sleeping

▼ **Only rarely** did the forbidding peak disrobe for the climbers who sought to conquer it. From this point they crossed a number of gorges and ridges which took them out of the picture to the left. They ultimately ascended the knife-edge at extreme left, up to the snow line

enemies. For four hours we crawled like snakes up the skeleton buttresses of the volcano and reached a snow field at 3:30 in the afternoon. And then—we entered the region of Sun!

For two and a half weeks we had lived under the Shroud, veritable frogs with water below us and above. Now we had reached its upper edge and were faced by an intolerable fire that burned into our eye sockets. The glare of sun on snow was terrific. None too soon we donned metal eye-slits and surveyed the amazing new world we had entered. Below us stretched a sea of clouds clear to the horizon—north, west, and south. Its glittering snow-white billows formed the roof of the Shroud and concealed the dismal abysses below. To the east the tongue of ash on which our tent was standing ceased, and a gleaming snow field carried the eye up to the top of a perfect snow cone, outlined in startling relief against a sky of deep ultramarine. The slope seemed invitingly easy, but the morrow proved it an illusion. The appearance of a gentle slope was caused by a flat foreground, lacking shadows, that merged unseen into a steep ascent.

As we gazed, cloud wisps shot up out of the Amazon basin and, enlarging to great cumulus masses, catapulted upward at terrific speed, blotting out the summit. At the same time, the air column lifted the curtains of the Shroud behind us and for a moment revealed the entire route over which we had come during the past two weeks. The knife-edges, the Labyrinth, the Rio Volcán, Carniceria, and finally the whole valley of Culebrillas, its snakelike river, and even the white tent where we had said farewell to Carlos eleven days before, were visible through powerful glasses.

As we watched in astonishment, the dropping temperature warned us to prepare for a cold night. I sent Lewis and Manuel back to Camp Sangay with instructions to bring up the needed equipment. They took the ice ax to negotiate the "Knife-edge." We lit the optimus heater, thawed our frozen imaginations, and cooked a wonderful dinner of our last rice and raisins, using water from melted snow. Crawling into sleeping bags, we expected a cold night, but the ash beneath was warm and would have induced sleep had it not been for other causes. Confident the frozen-in ropes would hold, we were just falling into a doze when a terrific blast shook the tent. With it came the sharp impact of ice pellets against the frozen canvas. Neither of us spoke, but both were keenly aware of impending danger. Plainly the vertical air currents that had skyrocketed from the Amazon were tearing the Shroud to shreds and turning it into a hurricane of snow and hail. The Demon of wind pounded our tent with titanic force. The four-foot tent pole bent into an alarming bow. When the bow released, the tent canvas snapped taut with a report like gunfire. The ropes whipped the ice. Powerful gusts of the storm rolled under the ice cloth and lifted us bodily into the air, dropping us with a thud.

With only two in the tent, visions came of being rolled—tent, contents, and all—over the ridge to the west and down the half mile of ice. We bulked our weight strategically on the windward side behind the cut Terris had made in the ice wall. For four hours the wind buffeted and thumped us, and then came a marvelous calm. This lasted only a half hour, when once more the pounding renewed its onslaughts. Two more hours saw it slacken and allowed a few minutes' sleep before sunrise, when we rose for the contest with the frozen volcano. As I crawled through the low hole, a bleak scene greeted tired eyes. The ash tongue was drifted, and the tent walls were stiff with the impacted debris of the blizzard.

The morning light revealed that the heart of the volcano was not frozen by any means! At a distance, the conclusion had been drawn that no "smoke" was being discharged from the crater and that the so-called "most frightful volcano in the world" was extinct. Now, at close range, it was clear that gas clouds were being emitted, but the gases were unusually colorless. In comparison with the dense masses of gray emitted by Vesuvius, El Sangay's fumes are transparent. And yet they were pouring forth in great quantities. The giant was merely asleep and breathing heavily. The cone was perfect, greatly in contrast with the truncated top drawn by Whymper 50 years before, indicating that it had been quietly building for some time and that the orifice was choked with ash. These conditions are deemed an augury of early activity. It did not give us concern, since an eruption is generally preceded by seismic disturbances of a violent nature, and up to this time we had experienced only one violent earthquake, although there had been many minor "shakings."

These were the things we discussed in the predawn light, while Terry busied himself with breakfast and I endeavored to photograph the still swirling clouds. Although the wind had moderated, it bent the stiff tripod legs like willow wands and pierced bare hands to the bone. A sudden gust tore away the parka I was using as a focusing cloth and hurled it down the western ice slope. The night's snow was picked up by the gusts and stung face and hands like a whiplash. Absorbed in the difficulties of my work, I did not at first notice an increase in the whistling sounds about me, until I was startled by the passing of a large object near my head. Glancing downward I could see it bounding on the ice. It was a ROCK! Twice as large as my fist! Above me others were ricocheting on the uneven slopes. Clearly they were coming from the summit. Was it an eruption? I instantly dismissed the thought when I noticed they were not incandescent. Later we saw many of them lying quietly on the icy slopes near the crater. The powerful winds had disturbed them and set them in motion. If they had been projected from the crater for some time and frozen in the surface, it proved how powerful the wind had been to wrench them from their resting places.

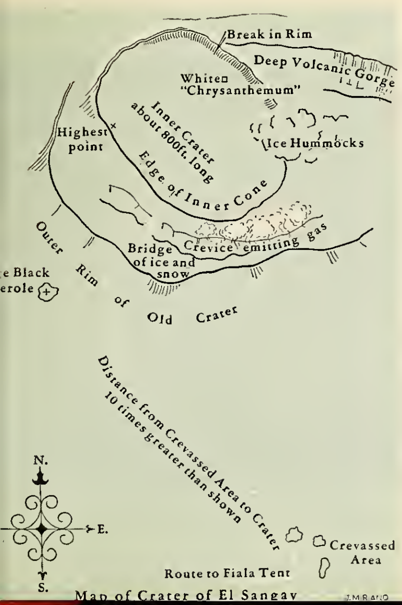
Dropping the tent to save it from wind and rocks and using the tent pole as an ice ax, we started for the summit. Our Paulin barometer indicated we were now at an altitude

◄ AT THE LOWER EDGE of the snowcap of El Sangay. As the men lay on the canvas floor of the tent, a tempest raised them bodily and threatened to hurl them, tent and all, into the abyss

▼ A GORGE UNEXPLORED until the Moore Expedition penetrated it: the ravine of the Rio del Volcán. It made a welcome route to the very base of El Sangay. And in it was discovered a bird new to science—the beautiful Golden Tanager, *Tephrophilus wetmorei*

of approximately 16,000 feet. Assuming the triangulation of the mountain to be correct, we had about 1800 feet of altitude to negotiate. Later we discovered that an inner cone had built up almost to 18,000 feet in elevation.

A few steps convinced us we were on the steepest side of the cone—the western. A direct ascent would be impossible without the ice ax, which Lewis had taken the night before for his return over the knife-edges. The frozen slopes rendered our snowshoes valueless. We had brought them and reduced the ice axes to one because Whymper's historic ascents of Andean mountains had indicated that most of them were covered with deep snow. This proved to be true of Mt. Chimborazo later, but above the 16,500-foot level, El Sangay was glare ice. If we were to make the ascent this day without ice axes, we would have to head for the southern slope, whose silhouette against the sky indicated an easier gradient.


Break in Rim
Deep Volcanic Gorge
White
"Chrysanthemum"
Inner Crater about 800ft. long
Ice Hummocks
Highest point
Edge of Inner Cone
Crevice emitting gas
Bridge of ice and snow
e Black
erole
Outer Rim of Old Crater
Distance from Crevassed Area to Crater 10 times greater than shown
N.
E.
S.
Crevassed Area
Route to Fiala Tent
J.M.RAND

Map of Crater of El Sangay

It was on this southern slope that Dyott had plunged into deep snow and crevasses, but its easy grade was too inviting to be resisted. Furthermore, we would avoid the dangerous fumarole directly above us. We headed obliquely upward shortly after dawn. Soon the surface became so slippery that steps had to be gouged with the metal end of the tent pole. The force of the blows broke the pole. The slope became steeper. Terry slipped twice and barely prevented a long glissade. Another sharp blow with the pole sent the unbroken half flying down the ice field; it dropped out of sight a quarter of a mile below. In a vain effort to catch it, Terry took a long slide but succeeded in stopping himself on a flat area that saved him from disaster. We returned to the fiala tent, defeated. A cold lunch followed. It was impossible to cook outside the tent because of the wind, and the tent could not be raised without the pole. A sparkling afternoon tempted us to try again.

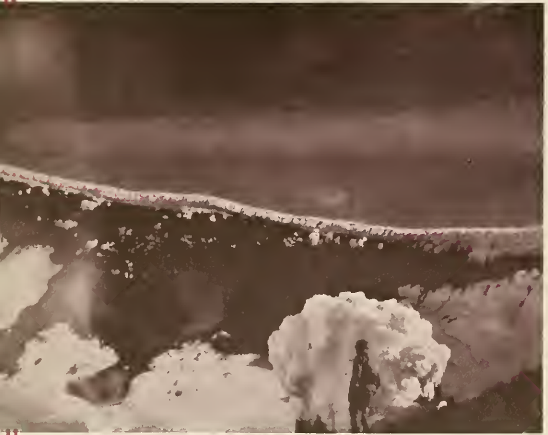
Considerable time had been spent in a successful attempt by Terry to recover pole and parka in the cinder field below. His energy was astounding! Every step was costly, a severe strain on heart and lungs in this rare atmosphere three miles above the sea.

Once more we pointed upward. The old steps made progress faster. The surface had melted slightly under the direct rays of the tropical sun. By 3:30 we had passed our old mark and reached an area of curious hummocks and mammoth formations. Some of these forms were 50 feet in height and conjured thoughts of titans of the last Ice Age. Obviously they indicated the beginning of a crevassed area—probably the sector that had defeated Commander Dyott in his courageous effort, after all his companions had been stopped by fear or mountain sickness. As Terry changed films to photograph the area, a sudden gust tore the film adapter out of his hands and sent it sliding down the mountain. It might have stopped on the softened surface had not some queer trick of fate turned it on edge and whirled it at a fast rate. The summit did not seem more than 1000 feet above us, but without camera as witness, an ascent seemed of doubtful value. Reluctantly we postponed further effort until the morrow.

Waddell and Lewis, without Manuel, reached the tent at 5:30 P.M. They brought good news. Teodomiro and the peons had reached Camp Sangay with deer meat. We could devote one more day to the ascent with fair regard for the safety of the party. Unless we should be impeded by swollen rivers, it would be possible to get back to Culebrillas by husbanding our rations. We spliced the broken tent pole with the ice ax that Lewis had brought and once more enjoyed a cooked dinner of hot venison and fried potatoes. The crowding of four persons, four sleeping bags, cameras, and other equipment into a six-by-six tent caused much amusement and took one and a half hours.

At 5:30 the next morning we were up. We plastered our faces with a thick coating of cold cream and cinema paint. Three inches of snow had fallen during the night and completely obliterated our tracks of the

▲ ABOVE THE sea of clouds that hangs almost incessantly over the lower slopes of El Sangay. Beneath it, the Indians say it rains every day in the year



▲ THE "CHRYSANTHEMUM": a pompon of ice. It was supported by a stalk of ice more than 50 feet in height, the base of which was concealed by the billowing vapors of gas within the crater

▼ TITANS FORMED of ice dotted the glaring landscape up which the climbers struggled. It was probably in this area that Commander G. M. Dyott fell into a crevasse and nearly lost his life on his unsuccessful attempt to reach the summit

▲ On the highest point of El Sangay. Dr. Robert Thomas Moore is in the center, his son Dr. Terris Moore, now President of the University of Alaska, is on the right, and Waddell Austin of the University of California is on the left. Dr. Lewis Thorne is taking the photograph. None of the Indians would climb to the top to face the God of El Sangay, whom they feared

previous day. As the surface was frozen beneath, the snow made the going treacherous and compelled us to cut steps with the ice ax, retarding progress. Five hundred feet below the "hummocks," Waddell was struck down with "siroche," the curious mountain sickness that had incapacitated the great explorer Humboldt on Pichincha 127 years before. He lay flat on his stomach, attacked by violent nausea and headache. In accordance with previous agreement, the rest continued, but a half mile from the crevasses I ordered a pause and luncheon of hard chocolate, in order to watch the prostrate form below and determine if assistance would be needed. To our utter astonishment he picked himself up and stumbled toward us. Several times he fell prone on the ice only to rise again. At length he reached the party, and after a long rest and a bite of bread he continued courageously on. Throughout this hour, we had clung to a steep icy slope, with backs to the ice and heels in precarious toe holds.

From the hummocks we veered back toward the north, to avoid the crevasses on the south side of the peak, and took the steep western pitch, even though it obviously would require ice-cutting to the top. The use of the ax proved an increasing effort for persons loaded with cameras, tripods, alpine rope, barometer, and minor equipment. Turns were taken, but progress was slow. After several hours the slope eased up, and at the end of another half hour a soft area was reached where cutting could be abandoned. The large black fumarole, observed from Culebrillas, loomed to our left. We narrowed our zigzags to avoid it and headed directly for an icy ridge above us, from which clouds of white fumes were pouring. Ropes were now in use; they were tightened for the last effort. I took the lead, heading straight for the summit. At 1:15 P.M. we reached the apparent top, to discover we had surmounted the outer crater only. An inner cone from which masses of gas were pouring, rose still higher by several hundred feet. At our feet, between us and the base of the cone, yawned a gas-emitting crevice, which, as it curved to the south and east, widened to the proportions of a gorge. Outrushes of gas obscured the abyss, and its walls were fantastically draped with icy stalactites.

To our left the gorge narrowed. Over this a bridge of ice and snow offered a possible approach to the inner cone. I started across and broke through. The fall stopped suddenly with a thud. My feet were on hot ash below, which had melted the ice on its underside, and my neck was encircled by the surface ice. Scrambling out, I started up the ascent on the opposite side of the crevice. Breaking through the icy crust every few feet, we reached the edge of the inner cone and gazed down into the murky depths of the real crater, which never before had been viewed by the eyes of man!

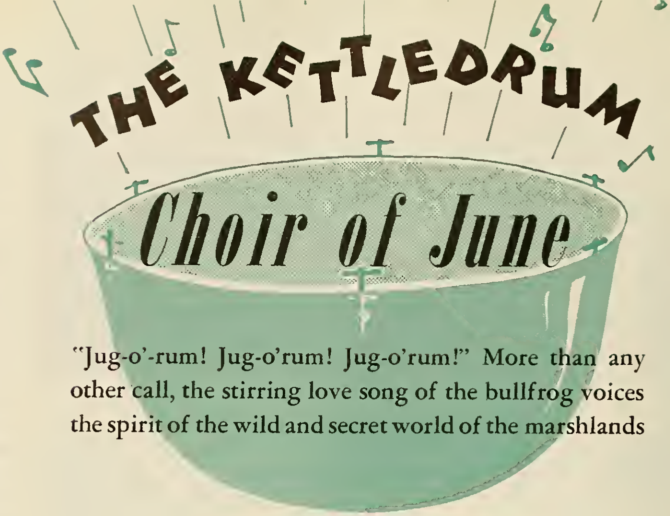
The rest of the ascent around the frozen rim to the highest point of the southwest rim—the actual summit of the volcano—was easy. Standing there, we photographed each other. We did not know until later that we were really on a shelf of ice, extending out into, and actually overhanging, the abyss of the crater below! It was 1:50 P.M. of August 4th, 1929. Twenty-one days had elapsed since we had started on the trip, and during this time rain or snow had fallen every day, and most of the time every hour of the day! No wonder Lewis seized his harmonica and played a tune of triumph to the defeated God of the Crater. No one but our four Americans reached the summit. The Indians feared to face the "frightful God of El Sangay."

But there was much still to be accomplished if the appearance of the historic crater was to be recorded. Four cameras had reached the summit—an ordinary film kodak, a compur, a motion picture outfit, and a 5 x 7 for recording natural colors. The next three hours were employed in securing photographs of the fascinating phenomena about us. An ultramarine sky arched above us and reached the tone of indigo at the zenith. Slightly below our own level, the tumultuous ceiling of the clouds stretched for endless leagues. They were white when the gases from the crater blew to one side but tinged with gray when they interfered. The snow at our feet on the crater rim was tinted by the fumes, and it impinged on the tongue a nauseous taste like ammonium chloride. Great clouds of the gas interfered with the photographs and at such times took on a dark shade because of their density.

The main axis of the crater ran northwest and southeast. We were standing on the southwest rim, which actually overhung the sheer walls as they dropped into the smoking gulf. The crater must once have been much greater in diameter, perhaps a half mile; but in recent years a new cone had built itself several hundred feet higher into the air, and

Continued on page 286

THE KETTLEDRUM Choir of June



"Jug-o'-rum! Jug-o'rum! Jug-o'rum!" More than any other call, the stirring love song of the bullfrog voices the spirit of the wild and secret world of the marshlands

By BEN EAST

Photographs by the author

IT lasts for about five seconds, rumbling and thundering around the reedy margin of the lake. Then the June night is still, save for the soft wind in the maples and elms, for 20 to 40 seconds. After that the Old One speaks once more and the others join in, and it starts all over again.

It's a deep and vibrant song, like a dozen bass fiddles crying "Jug-o'-rum! Jug-o'-rum! Jug-o'-rum!" over and over again. It's the incarnate voice of the warm nights of early summer, wherever there are marshlands. It's the kettledrum chorus of June, the mating song of the biggest frog in North America, the throaty bellowing by which the bullfrog courts the lady of his choice.

Some frogs croak; the tree frog and the common toad trill loudly and clearly; the tiny spring peeper plays sweetly his Pipes of Pan. But the bullfrog, giant of the tribe, has vocal equipment to match his bulk and his solid, squat appearance. He bellows a resonant, thrumming roar that can be heard a mile or more across fields and water on a still night. It has earned him his name of bullfrog. It is the loudest low-pitched sound to come from the throat of any cold-blooded animal in the United States north of the range of the alligator—and to those who know intimately the lakes and ponds and rivers, and the green jungles that border them, it is one of the most stirring and interesting of the many noises of summer nights.

The time for it to begin, in the lakes and marshes of the northern United States, is in late May or early June. Wild roses are in bloom at the roadsides, white water lilies are opening their immaculate, gold-hearted stars along the pond margins. There comes a warm still evening, and after sunset, when the late-spring dusk is settling over the land, the first bullfrog song of the year rolls up from lake or pond—a thundering kettledrum solo, or maybe a duet, that pulses and throbs and seems to shake the ground itself.

Those who live in the marsh country know then that summer is at hand. That is the unfailing harbinger, the sure forerunner, heralding summer as the first bluebird song and the first liquid notes of the red-winged blackbirds in March foretell spring. In a few more days the clover fields will be fragrant with bloom, the wild strawberries will ripen, the wheat will begin to turn bronze.

As a boy, I lived in a region of ponds and marshes and small lakes,

◂ MASTER MUSICIAN of the marshes: the bullfrog, herald of summer in southern Michigan. Bullfrogs abounded there, and their singing was as much a part of the nights of early summer as the flight of the fireflies over those same marshes. Countless nights I lay awake in my room under the eaves of the old farmhouse, dreaming the long dreams of boyhood, shunning sleep deliberately that I might enjoy as late as possible the Jug-o'-rum song booming over and over again through the warm darkness.

No sound of the outdoors meant more to me than that throbbing, thrumming music from the lake margins. It spoke of lily beds, of coves where pickerelweed made a blue fringe in the shoals and big bass lurked in their underwater lairs. It hinted at secret bogland nooks where pitcher plants lifted their strange and treacherous urns of death, where showy lady-slippers hid their wine-stained white chalices in the green marsh tangles.

Not many in our neighborhood knew where the pitcher plants and lady-slippers grew, but I knew. They grew in the remote, untraveled thickets of the marsh, and the big frogs were part and parcel of that wild and alien and alluring world. They shared it with bitterns and nesting rails, thick-bodied water snakes and log-sunning turtles.

It was a world that lay literally at my dooryard, yet it was far removed from our upland fields, from the farmlands where we lived. Few penetrated it, few ever came to know its creatures and learn its mysteries, or so at least it seemed to me as a boy. It was a world that drew and held me by its wildness and aloofness, its secret places and its sounds and smells, its sinister wetness and the things it spawned. And to me the bullfrogs were its first spokesmen, its foremost singers, its great troubadours, relating its story, interpreting the spirit of the marsh itself as none of its other creatures did.

For me they still play that role. I moved back a few years ago to that same neighborhood. I live now on the farm where I grew up. And I await the kettledrum choir each summer as eagerly as ever and enjoy it as hugely.

Unlike many frogs, the bullfrog does not sing in unison in a true chorus. Or so, at least, the herpetologists contend. On the other hand, he rarely enjoys the chance to sing alone.

The bullfrog population of a pond, small lake, or section of marsh may consist of from half a dozen to two score or more of the big batrachians. And as often as one starts to sing the others join in, adding their voices to the clamor as if the first concern of each were to outdo all the rest. As a matter of fact, it is highly probable that this is exactly the case. Evidence and reason alike indicate that true rivalry inspires the performance. After all, the song is a courtship ritual, and through a long evening or an entire night the big frogs continue to thunder at irregular but very frequent intervals. Each time the first member of the choir bellows, the others simply cannot keep silent.

I have timed the thrumming chorus many evenings, on the medium-sized lake that lies at my door. They average about two performances per minute, each period of song lasting from four to seven seconds. But the rhythm of the singing is not entirely regular. Even at the peak of the mating season the periods of silence may endure for as long as 50 seconds or may be no longer than 20.

Always it seems to be the same frog that touches off the whole kettledrum orchestra. Whether he is the acknowledged leader and the others await his signal to begin, or whether the entire choir runs out of breath and regains it at precisely the same time and in the same order, I cannot say. The former explanation seems the more logical, however. At least I have observed, whenever I have timed the frogs (and, for that matter, through all the years I have listened to their singing) that almost unfailingly there is one voice that trips the symphony and that the others of the neighborhood follow time after time in the same sequence.

Frog A, on a reedy point at the east end of the lake, may open the number. Frog B, over in the lily cove a quarter mile away, sends his voice thundering forth a split second later. Frog C, down by the inlet, trails immediately, and then the entire group is bellowing in pulsing, broken cadence. Silence falls, and half a minute later they begin all over again, in exactly the same order.

Often there is one dissenter that

➤ One frog touches off the orchestra, and the other kettledrums chime in

➤ Sometimes his worst enemy is the man who wants frogs' legs for supper

▼ In his double world of air and water, the bullfrog faces danger from both above and below

insists on keeping out of step, singing his complete song time after time midway of the periods of silence, when no rival is articulate and when he has lake and marsh and all the night completely to himself. It seems there are rugged individualists even in the amphibian world.

In between the periods of deep-toned singing, in the green rushes along the shore, lesser characters will say "Grunk!" over and over again, in voices not without music. They are green frogs, closely related but smaller kinsmen of the true kettledrummers.

Almost unfailingly it is possible to distinguish the voices of individual frogs, especially those of outstanding size. One spring we listened night after night to one that far outbellowed all the others. From the timbre of his song, from both its pitch and volume, we felt sure he must be a frog of gigantic size, a veteran that had survived abnormally long the multiple hazards that beset the lives of all frogs, even the biggest of the clan.

We named him the Old One and came to listen for his thunderous, earth-shaking notes to open the night's performance as dusk deepened over the countryside. His singing area was in a mixed bed of rushes and lilies, on a lake that lies across a narrow neck of marsh beyond ours. A channel wide and deep enough to permit passage with a small boat connects the two lakes.

Finally, close to the end of June, the night for the bass fishing to open came. There would be fishermen afloat in numbers on both lakes once midnight arrived. They would cover each yard of the reedy shallows before morning, and many bass fishermen are addicted to frog-leg dinners. It is a simple matter to take the kettledrummer at night, with club or spear or snag hook, by blinding him with a flashlight as he sits hunched

◄ You may not see him near by but his music resounds far and wide

in shoal water. He can even be tempted into snapping at a bait or artificial fly dangled on a short line in front of his nose.

Knowing these things, and fearing for the safety of the Old One that night, we decided when darkness fell to organize a rescue expedition. Obviously, we could not hope to save all the bullfrogs in the lake, but perhaps we could save that one. And if we moved him to a dense patch of rushes close beside our boat dock, he might escape molestation and survive the whole summer there.

He was easily located, for the night was warm and he was singing powerfully. We rowed through the channel into the second lake and turned down the shore in his direction, making as little commotion as possible. A few yards from him we pushed the boat into the rushes and turned the bright beam of a flashlight his way. We picked up his big, bulging eyes, shining like twin embers, and the squat outline of his head and shoulders lifted above the water. I shoved the boat in slowly until the stern was within arm's reach of him.

He stopped singing, and just as I leaned down to grab him, he took alarm and crash-dived. But the romantic mood of the evening betrayed him in a curious fashion; he was so inflated with air, as an essential part of his tremendous vocal performance, that he could not stay submerged! He drifted to the surface almost immediately and hunched there beside the boat, a badly handicapped leviathan of a frog, a victim of his own ardent mood, unable to escape but unwilling to deflate.

I scooped him in and we took him home. He spent the night in cramped quarters in a bucket. In the morning we took him to the dock and set him free, anticipating with pleasure his vibrant singing at such close range in the nights to come.

But he had other ideas. He had a home range, a singing area of his own, and he proposed to return to it. The first evening we heard nothing from him. But the evening following, exactly 48 hours after we had captured him, he was singing again as lustily as ever—back in the patch of rushes and lilies in the second lake, where we had heard him first. It had taken him two days, apparently, to travel down our lake, through the channel, and along the shore to his chosen location. That he had made it without mishap was little short of a minor miracle.

He sang there the remainder of the season, but he sang alone. We did not hear the voice of another bullfrog on either of the two lakes again that summer. The fishermen had made a clean sweep, it seemed, that first night. But at least our scheme for the safety of the Old One had succeeded.

The bullfrog comes late from hibernation, the males appearing two to three weeks before the females, and they start singing almost immediately after they emerge. With the end of the breeding season, the kettledrum choir slackens and falls silent. It is heard with decreasing frequency after early July in the north and rarely later than the middle of that month.

On the night of July 13 last summer, one persistent choralist was still singing infrequently, at long irregular intervals and by himself, in our lake. Thereafter, we heard the kettledrummers no more. The hot, dry weather of midsummer and the waning of their courtship ardor had stilled at last June's thundering chorus.

No, not quite stilled, after all. For much to my surprise, on a warm and cloudy day on September 16, a bullfrog sang a few times from the far side of the lake. He managed only two or three desultory notes at a time, as if aware of the futility of such things when summer was dying and his own personal year coming to a close. Yet seemingly he could not quite restrain an inner impulse to set the earth trembling one final time with sonorous music before he retired into winter hibernation.

Bullfrog spawning, like that of most tailless amphibians, in the temperate regions, is governed by water temperature. Not until the water is warm enough for rapid incubation, 60 to 70 degrees, are the eggs deposited. Each female produces from 12,000 to 20,000, laying them in large masses at or near the surface, usually attaching them to submerged reeds or other aquatic vegetation. Each egg, half white and half black, is surrounded by a ball of jelly-like material that binds the spawn together in a squarish mass or wide ribbon. The tiny tadpoles emerge in about four days.

The bullfrog tadpole is a dapper and handsome fellow, straw-colored beneath, brownish-green above, with fine yellow dots over all the body and black spots on the tail. He grows slowly, spending at least two years in the tadpole stage, and he will not transform into adult until the third year if his food supply is scant or other environmental factors are unfavorable. Normally the tadpole is about two inches long when metamorphosis occurs, but in extreme cases he may attain a length of more than five inches before quitting the water for the shore. The transformation usually takes place in July or August. Another five or six years must then pass before the frog reaches maximum size, at which time, if he has lived well, he will boast a body length of six to eight inches, an over-all length of almost double that.

As a tadpole he feeds principally on algae and other vegetation, taking in addition a few small aquatic insects and other animal food. As an adult frog he turns entirely carnivorous, and his taste is cosmopolitan in the extreme. Although his principal fare consists of insects, small crawfish, snails, worms, and spiders, he will take almost anything his capacious jaws can close upon, provided it is not more than his match in one way or another.

Often falling victim himself to a big bass or pike, he does not hesitate in turn to gobble up any fishes small enough to be swallowed. The water snake is one of of his most dread enemies. As often as a suitable opportunity presents itself, he pays his debt to the reptile clan by capturing and swallowing any snake that comes his way and is small enough to be vulnerable. He must live in constant fear of the big, vicious turtles that share his warm-water shoals. Yet little turtles are often found in his own belly. Herons and bitterns are among the deadly perils of his world. He evens the score by pulling under an occasional unwary wild duckling, young coot, or other water bird. He is not above snapping up other frogs smaller than himself.

He lives in a ruthless, murderous world at the margin of pond or lake, a place where marsh and water meet and death can come from overhead or underneath with equal swiftness. The law of that world is eat or be eaten, kill or perish. And for all his warm and vibrant love song, for all his harmless and even dull-witted appearance, for all the benign demeanor of his big protruding eyes and the upturned corners of his wide, comic-character mouth, the bullfrog is without mercy where things smaller or weaker than himself are concerned. He is a cold-blooded and efficient hunter of the shoreline jungles, rush beds, and the lily thickets, as he must be to survive.

But to those for whom the marsh has allure, he is foremost and above all else a musician of early summer that has no peer.

Professional frog hunters, taking him for market and for their own tables, all but wiped him out on the lakes where I knew him long ago, between my boyhood and the time when I returned to that same country years later. But the bullfrogs are making a comeback now, and I am glad. They are a part of the marsh country that should not be lost—sturdy, outdoor characters well worth protecting and preserving. If you have not heard their resonant, sonorous music in the warm and fragrant nights of early summer, you do not know all the fullness of June.

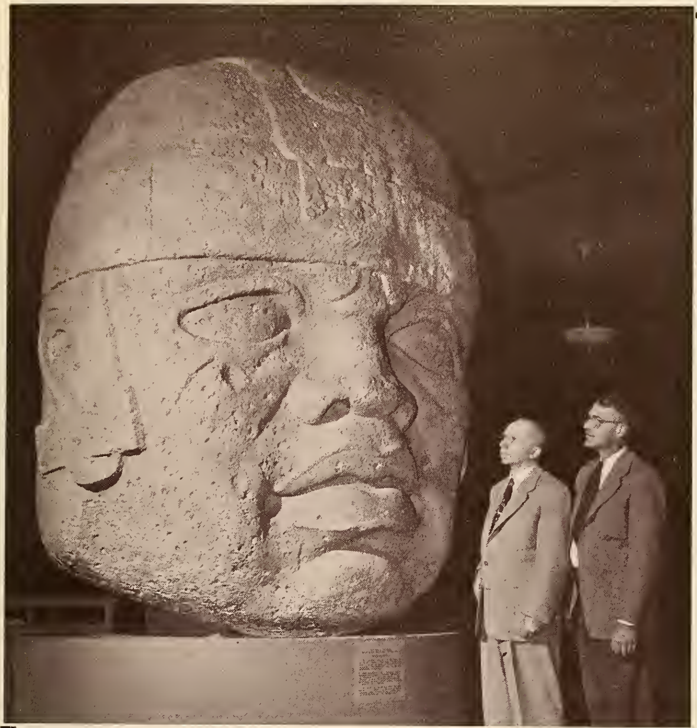
CARPET BEETLES *Continued from page 263*

seum Beetle (*A. museorum*) is one of the few members of the family that shows a preference for dried plants, and its depredations have destroyed many valuable herbarium specimens. Of course, it will also attack most other things that carpet beetles like.

The Furniture Carpet Beetle is a rather recent settler in America, having first landed and become established in this country less than 50 years ago. Its feeding habits are quite peculiar. While it will attack most animal products, it will starve to death on a diet of pure wool. But if the wool is dyed, it can reach maturity. For the most part, it confines itself to the interior of furniture and chairs. Its chief stronghold in America is in Washington, D. C., where it has developed into a serious pest. In other parts of the country, the damage done is sporadic and occurs chiefly in the homes of the wealthy. The Furniture Beetle does not make any effort to select opulent homes; rather, wealthy people unwittingly select the beetle. Almost all the isolated but numerous cases of damage by this beetle have probably been the direct result of importation of antique furniture from Europe or adjacent regions. In the two serious infestations that have come to my attention, this was obviously the case.

The first of these was located in Virginia, where two pieces of furniture were heavily infested. Here, the larvae confined their feeding to the stuffing, and they might have continued to flourish there for many years had not the adults made a nuisance of themselves by coming out and swarming about the windows in an attempt to reach the outside. In this beetle at least, the adults do not need to feed in order to reproduce; they can continue for innumerable generations on the inside of a piece of furniture, the owner entirely unaware of their presence.

The second infestation was near New York City and was extremely severe. Most of the furniture was of European origin. It was not possible to determine when the beetles had arrived in the house, but for several years the adults had been increasing greatly, and at the time the examination was made, thousands of them were present. The larvae had overflowed from the furniture to the rich carpets, which in many places were honeycombed. Beneath many of the pieces of furniture large patches of the rugs had been eaten away. Not a room in the house was free from adult beetles. They were in the furnace room, trying to get out through the glass window, and in a large storage room in the cellar they were swarming over everything. Their breeding place may have been in any one or all of several dozen pieces of furniture. On the first,



Acme

"THE KING"

The largest stone head ever found in the Western Hemisphere

THIS reproduction of the largest carved head ever found in the New World now dominates the Mexican Hall of the American Museum of Natural History. The head is 9 feet high, 6 feet wide, and 20 feet in circumference. It is believed to have been carved at the beginning of the Christian era.

The original head was discovered near San Lorenzo in the state of Vera Cruz by Dr. Matthew W. Stirling, Leader of the National Geographic Society-Smithsonian Institution Expedition to Southern Mexico. In 1947, the American Museum sent Dr. Gordon F. Ekholm, Associate Curator of Anthropology, to Mexico to make arrangements for reproducing it. The head was cast in plaster, and 52 sections were transported from the jungle in river boats and shipped to Mexico City, where 16 large sections were cast. These were shipped to the American Museum's Department of Preparation, where they were assembled and the finished reproduction completed.

The name by which this magnificent sculpture is known, El Rey ("The King"), was given by the native workmen, who were impressed by its huge size. Today the original head still lies in the jungle where it was found. It weighs fifteen tons, and the task of transporting it would be tremendous. One of the mysteries of El Rey is how the ancient people were able to move it nearly 60 miles over rough country from the place where the stone must have originally been quarried.

Living long before the Aztecs, the ancient people of the Olmec country who carved the head may have been contemporaneous with the early Mayas and represented the earliest high culture in the New World. Artists and sculptors who have seen the reproduction call it a great and outstanding work not only of early Mexican art but of any period of culture, particularly since it was carved with stone tools.

second, and third floors, there were dozens of them around each window. The linen closets and other storage places upstairs had their quota.

The amazing thing about this infestation was the relatively small amount of damage that had been done. Had the Black or the Buffalo Carpet Beetles been present in such numbers, there would have been little or no undamaged materials of animal origin left in the house. The condition inside some of the infested furniture must have been appalling, and I have often regretted that I did not open some of it to see just how thoroughly the stuffing had been chewed.

Special Control

In many instances the control of unusual infestations of household insects requires special treatment. Here is an outstanding case of this kind. The problem was to devise a proper kind of spray that would have a number of characteristics. It had to be sufficiently volatile and penetrating so that its fumes could be forced into cracks and crevices and into the furniture itself. It must leave an endurable killing residue. It must not bleach or stain the most delicate fabrics. And it must be fireproof. The last major consideration was safety to warm-blooded animals, including the men and women in the house.

Every commonly used insecticide, solvent, and diluent was considered. A few hours of deliberation with Mr. V. B. Durling resulted in a spray combination that should have all the qualifications desired. Several methods of application were considered, and what proved to be the proper one was decided upon. We had relied upon a lot of theory in evolving the spray. We knew that only a rigid test would prove its value. The logical place to make the test was in the most heavily infested place in the house—the basement storeroom. When, 48 hours after spraying, there was no sign of insect life in the storeroom, and no materials, including many delicate things that had been placed there especially for the test, had been damaged, the rest of the house was treated. The instance cited above is an unusual one, since the infestation was of a rare type.

General Control

All of the methods used for control of clothes moths have been employed in an attempt to prevent damage by carpet beetles, but, unfortunately, carpet beetles are much more difficult to kill than clothes moths. Whereas the clothes moth larvae may be killed by dichloricide fumes in five to twelve days, the beetle larvae may require from ten days to three weeks.

Naphthalene and camphor have little effect on the development of larvae, but these materials do prevent egg-laying.

Cold storage is a big help in controlling carpet beetles, but it does not necessarily kill the larvae. Rather, it drives them into hibernation. Even the Furniture Carpet Beetle can probably survive the winter out-of-doors in the southern half of the United States. The larvae are probably able to go without food, at low temperatures, for as much as six months, and at temperatures above freezing they probably nibble a bit. However, damage at temperatures below 40 degrees F. would be negligible.

Hanging household materials in the sun is usually not very effective. The larvae merely crawl to the darkest and coolest place and stay there until the materials are returned to the house or until the sun goes down. However, if the materials are brushed at the same time, the pests may be eliminated. Frequent examination of stored materials and spraying of the containers, inside, will prevent serious infestation.

DDT, Chlordane, or deodorized Benzinehexachloride (BHC), used in the proper solutions and properly applied, will give protection. I prefer a one per cent emulsion of any one of these, which can be forced by pressure into rugs and carpets and into the cracks of floors and walls. In the treatment of furniture, oil carriers should be used, especially if it is necessary to force the material into the interior of the article to be treated. Such sprays should contain a material to eliminate fire hazard. Fumigation in a vacuum chamber will kill all life in household furnishings that can be so treated, but it will not prevent reinfestation. It is not possible to control well-established carpet beetles with the type of spraying done by the average householder, who makes a few passes with a small gun in a clothes closet or on the surface of carpets. Carpet beetle larvae are tough customers, and it takes a lot more than that. A household gun usually holds a quart or so of spray; to do a real job against the carpet beetle you'll need from five to twenty gallons, and you'll have to apply it thoroughly. If you have carpet beetles in your home, you can figure upon about two gallons for each room, with two or three sprayings a few days apart.

Never spray anything until you have tested the material with a small amount of spray on a very limited area, to be sure that the color will not run or that the material will not bleach. Some of the new paints become spotted or run when certain sprays are used. Fur coats may lose their luster or even their color if not protected from direct spraying. Unless materials sprayed with emulsions, and often with oil bases, are thoroughly clean, they are almost certain to be stained.

There have been many cases where dyed furs and carpets have been ruined by a too liberal application of an oil spray. Usually, when staining results from the use of an emulsion, the stains can be removed by shampooing or surface cleaning. A rich suds is made from any light soap or soap powder; and a soft cotton or woolen rag is wet and squeezed until no water drops from it. The stained areas are then rubbed with light pressure until distinctly wet but not soaking. After a few minutes, the dampened surfaces are once more gone over with a soapless rag that has been soaked in clean, warm water and squeezed until almost dry. This is to remove all trace of the soap, and it may be necessary to repeat the process. If a ring still persists around the treated area, a slightly moist cloth soaked in a weak suds solution should be brushed lightly around the ring of stain, to be followed by vigorous rubbing with a dry cloth until no sign of the ring remains. The cleaned part of the rug will be apparent for a few weeks, but its color will gradually blend with the rest.

I have found that an electric lamp shade treated with DDT is effective against carpet beetles as well as clothes moths*, but it is much slower in its action. Carpet beetle larvae are generally very much more resistant to poisons, and it may be two or three months before they are eliminated from a clothes closet in which the shade is used.

Something to remember: If you mothproof a rug, blanket, or clothing with a water solution, laundering will remove the protective substance. If you use an oil solution, dry-cleaning will remove it.

Insect control in the household is a real problem, but if properly employed it will save money and bring real peace of mind.

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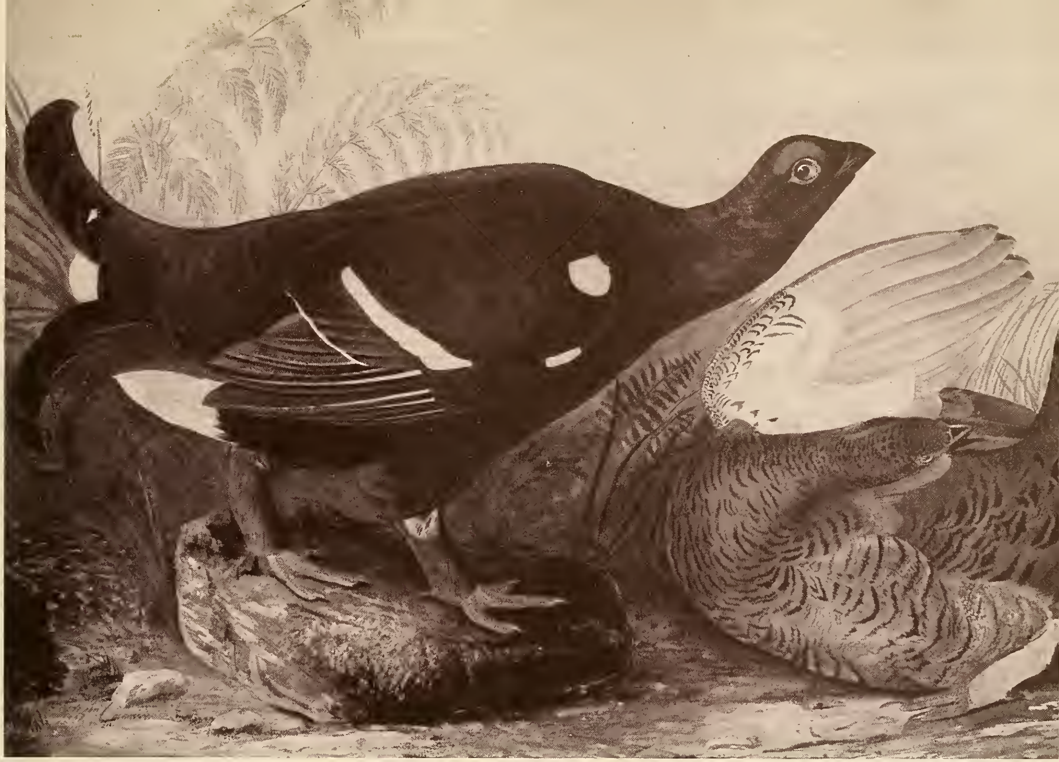
*See "Clothes Moths," by C. H. Curran, NATURAL HISTORY for September, 1949, page 330.



AMNH photo

▲ **EUROPEAN BLACKCOCK**: an extraordinarily well-composed and stylized water color. In the words of one authority, it makes most of the contemporary bird artists look like amateurs. This painting was completed 122 years ago

An Unpublished Audubon

By HAZEL M. HUNTER

JOHN JAMES AUDUBON was residing in London when he made this water-color drawing of two European blackcock. We believe this to be the first time that this little-known drawing has ever been reproduced. The original measures 18⅞ x 27⅞ inches and is signed at the lower left "J. J. Audubon 1828."

At that time Audubon was working with Robert Havell, Jr. on his publication of *The Birds of America,* and he presumably refers to this drawing in his "Journal" under the date of August 9, 1828, when he states:

"I wished again to try painting in oil . . . and have now before me eight pictures begun, but not one entirely finished. One of these pictures is from my sketch of an Eagle pouncing on a Lamb . . . Another is a copy of the very group of Black Cocks, or Grouse, for which Mr. Gally paid me £100, and I copy it with his permission . . ."

Since acquiring the drawing at an auction held in New York in May, 1949, we have endeavored to trace its history. The former owner was the late Mr. George H. Stuart III of Philadelphia. A member of Mr. Stuart's family very kindly informed us that the drawing was purchased by Mr. Stuart in London in 1924 from Henry Sotheran Ltd. Our inquiry to the Sotheran firm as to when and where they secured the drawing has brought a disappointing reply. Most of Sotheran's old records "were destroyed during the bombing of London," and no present member of that old firm remembers how they came by the drawing.

We like to think that when Audubon made our drawing of the male and female blackcock as well as others of European birds, he had in mind the publication of a series of drawings covering The Birds of Europe, which would be a companion to his now famous elephant folio edition of *The Birds of America.* We do not know what The Great Birdman had in mind 122 years ago except an unending interest in birds. We can be sure of that because his ever-courageous, steadfast, and helpful wife Lucy once admitted in a letter to her sister Eliza, "I have a rival in every bird."

Jumping Fishes

By Bucky Mc Donnell

WHILE talking to an old-time fresh-water fisherman, I mentioned that I could catch fish without a rod, line, bait, or cuddling. To my surprise, my friend looked perplexed and asked if my method was by traps, nets and snares, or shooting. "You haven't guessed it," I said, "so you probably don't know how to make fish jump out of the water."

The fisherman replied that, although he trusted my honesty, I'd have to show him my magic before he'd believe it. I was surprised that an experienced fisherman had not heard of this simple trick; but several other men who studied fishes scientifically were likewise unfamiliar with it.

I met my friend on the date set for a demonstration and spent the day swimming and hiking around Lake Tiorati, along the Appalachian Trail, where I have a shack. Every now and then he would impatiently ask, "How about the fish jumping out of the water? What are you waiting for?" My answer was the same all day: "There are too many people in the lake." I couldn't tell him why this was important to the success of my method, but I was certain it was. Despite my denials, he persisted in taking this loose explanation as evidence that I wanted to protect my secret.

Finally, evening came, and most of the people and boats cleared off the lake. As we pushed offshore in my canoe, my friend asked if I weren't going to take anything besides the paddles. I laughed, knowing he was sure that I planned to catch the sleeping fish with my hands. I could only assure him that, sleeping or not, the fish would jump and that he would be able to catch them.

I had paddled about three-quarters of a mile out into the lake when I cautioned my friend to be as quiet and as motionless as possible. It was now early evening. The sun was low, and the lake was like a mirror. As far as I could see, we were the only people on the lake.

I paddled hard, making sure not to strike the canoe or move my feet. Then I let the canoe glide to a standstill. I raised my paddle horizontally, about three feet above the gunnels, and then brought it down with a sharp rap across both gunnels at the same time. My friend sat amazed. As many as 200 fishes—pickerel, perch, catfish, bass, and others leaped clear out of the water all around us—some as high as two and a half feet and close enough to be knocked into the canoe. Those closest to the boat jumped the highest.

As I paddled for shore, I waited for a word from my friend. In a moment he said, "Bucky, I will believe anything you say from now on. This is certainly a strange thing. Will they jump again?" We repeated the act on the way to shore, and a few leaped out of the water close to the boat, but the response was not nearly so great as the first time.

My friend believed, as I do, that the sudden vibrations set up in quiet water react in some way on the fish's nervous system, causing the ones near the surface to break through.

My son and daughter have also helped me demonstrate this action to many nonbelievers.

THE FIRST ASCENT OF EL SANGAY

Continued from page 277

millions of tons of ash had encroached on the orifice until it was not over 800 feet in length. Normally the temperature must be colder than the day of our ascent, for not only was the entire rim sheeted with ice, but huge masses of it, as well as snow, had developed on the lower northeast side, and an astonishing amount of huge icicles depended from the overhanging southwestern rim. Other mounds of snow and ice had accumulated far down in the crater at points where the heat was less intense.

I pointed my camera into the cavern and waited a half hour for the gas to blow to one side, in order to record the curious ice hummocks extending into the depths as far as visibility might permit. The northeastern rim of the volcano was broken down for a distance of 200 feet. Through this portal, lava undoubtedly had poured at some period of the past and plunged down the steep slope into the Amazon basin three miles below. We made a circuit of the rim to the northeastern break in the wall. Here the descending knife-edge had frozen solid and proved too steep for snow to collect. We dropped toward the bottom of the crater by straddling and sliding but could not go far because of the gases.

On this lower side the beauty of the orifice reached maximum. Across the vortex rose the sheer wall we had just left. Its rim bulged with overhanging ruffles of snow, outlined sharply against the indigo sky. Below were the ebony walls of ash, patched with snow areas. Out of the depths at our feet, its base lost in the swirling gases, rose a strange formation, which rounded out into a perfect white chrysanthemum 50 feet in diameter and of unknown height. Its foamlike top glistened in the rays of the western sun. Interesting as was the gas-veiled floor of the crater, exquisite as was the frosted rim and the "chrysanthemum," nothing could equal the sublimity of the ice formations which had reared like blown spume of the sea over the southeast margin. Fantastic shapes predominated, huge and chaotic. As we faced to the north a simultaneous exclamation of astonishment broke from the lips of all. In the distance, ten degrees east of north, two gigantic fingers had etched themselves in glittering white above the billowing cloud masses. From the summits of her great candles, the unclimbed mountain El Altar had witnessed the conquest of her far-famed rival.

Climbing for the most part on our knees, we reascended the frozen eastern knife-edge to the northeast rim. A sudden blast from the prevailing east wind blew the Shroud back momentarily over the Labyrinth to the west and exposed one of the longest, almost perpendicular descents in the world—over three miles. The mystery of the constant renewal of the Shroud was revealed before our startled eyes. Far down in the superheated Amazonian cauldron, white puffs like mushrooms were continually forming. Humid currents of air were being forced upward by the tendency of heat to rise. Ascending the 18,000-foot slope, they entered the frigid atmosphere about the ice fields. The contact of heated currents with freezing temperatures results in rapid condensation, and clouds are born in a moment before the astounded eyes of the climber. This process keeps up for days, the ever-oncoming masses joining the Shroud to the west and constantly recreating it. The new clouds congeal on the slopes and thicken the collar of snow and ice. When El Sangay blows off its cap, the ice field dissolves rapidly, and the Labyrinth at its base is choked with a stupendous deluge of water and ice cascading down the precipitous sides. The flood boils and churns in the gorges, and masses of ash, catapulted out of the crater, choke the canyons and destroy every vestige of plant life. Indians who have ventured too far to obtain their delectable tapir are then caught in a trap. But the roots of the formidable sword-edged plant known as "paja" survive on the crests of knife-edges between the canyons and soon reclothe the ridges and plateaus with formidable clumps, two to five feet high.

We dared not linger longer! At 4:50 P.M., we said farewell to the inner rim. Then did the mountain witness a sight that would have delighted the hearts of the Scandinavian gods. In a gesture of exultation, the boys threw themselves into a glissade down the steep southwest slope. As their sliding, prone forms took on speed, momentum whirled them down the ice, and they disappeared in the flung spume of the snow. In 30 minutes they reached the fiala tent, a distance that had required 5 hours and 10 minutes to cover on the ascent!

The rest of the descent under the Shroud and the return to Alao were accomplished without much difficulty. The party suffered considerably from a continued diet of raw venison and sugar. Two of our Indians, while trying to recover the tent and equipment from the snow line on a midnight of storm, fell off a knife-edge and were rescued in a hysterical condition by Terry and Lewis. The rivers in the Labyrinth had risen above their previous flood levels but not sufficiently high to prevent threading a course through the canyons. Thenceforth the peons treated us as heroes and helped to make the return easy for the "Mad Americans" who had braved the wrath of their dreaded Demon. We dreaded far more the incessant rains, which continued unabated day and night, until we finally emerged from the cloud to the Valley of the Alao, there to lie prone for one hour of ecstasy under the balm of our own god—the Sun.

Only twice had the Shroud been rent during the return, once on Dorado Mountain at the twilight hour. It was the final view of the mountain we had learned to love. The last shafts of sunlight had long left the valleys, when the Shroud parted and revealed the God of Snows in a mood of sublime ecstasy. He had girdled his thighs with a band of royal purple and his chest with an ermine collar. But his head stood clear in the afterglow, flushed with beneficent gold. El Sangay was putting all the kindliness of a majestic being into one last farewell.

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Continued from page 245

Walton; he recounts the whimsical behavior of trout, he expounds upon the appeal of various lures, and finally he describes how trout should be cooked. Surely, every office-bound reader will wish to follow the example of Justice William O. Douglas.

H. E. Anthony

NATIVE ARTS OF THE PACIFIC NORTHWEST

Introductory Text by
Robert Tyler Davis

Stanford University Press, $7.50
166 pp., 194 photos, 5 color plates, 1 map

IN recent years one notes an ever-increasing tendency on the part of art museums to recognize the carvings and paintings of the Northwest Coast Indians as representing one of the world's great art traditions. It is gratifying, therefore, that so handsome a publication should have been devoted to this subject, heretofore largely unknown to students of the fine arts. In this photographic album, the first of a series of art books projected by the Stanford University Press, the fantastic productions of the Northwest Coast artist-craftsmen stand on their own merits and speak eloquently for themselves. The unity and uniqueness of the North Pacific tradition is immediately apparent, and it contrasts strikingly with the few Eskimo examples that have been included. In addition, Dr. Davis' text, though brief, is pertinent and provides the cultural setting against which the objects take on added meaning.

Nearly all of the examples illustrated were selected from the collection made by the late Axel Rasmussen of Skagway, Alaska. Considering the money, time, and effort expended on this lavish volume, it seems a pity that the editors should have so limited themselves, however outstanding this body of material may be. One result is that certain of the major classes of wood sculptures—house posts, grave monuments, and the so-called "totem poles"—receive almost no representation. Another is that some tribes, particularly the Tlingit and Kwakiutl, are emphasized at the expense of others, while certain important groups like the Nootka are not represented by a single specimen. In addition, although most of the objects have considerable eye appeal, some pieces are simply not of the highest caliber. The present album, however, is a significant contribution in the field of fine arts. The careful documentation, as well as the fact that the collection has not been illustrated previously, should make this volume of interest not only to the layman but to the professional anthropologist.

H. T. Tschopik, Jr.

LETTERS

Continued from page 242

nervous, and after my last shot he took off through the trees at a fast walk.

Jack W. Lentfer.
Livingston, Mont.

° ° °

Sirs:

Congratulations on the Fiftieth Anniversary of your distinguished publication, Natural History, and best wishes for every continued success . . .

Jorge A. Lines.
San José, Costa Rica

° ° °

Sirs:

. . . I want to congratulate the Museum most sincerely on the Fiftieth Anniversary of the Magazine, and the Editor on the article, "It's for You to Choose." . . . When you pass near the Hayden Planetarium, you ask yourself perhaps the same question as Nick Kenny:

"How can you look at a sky
full of stars
And say there is no God?
How would the flowers know
it was spring
Except for a smile from God?"

This is felt by all humanity, be it "black, white, yellow, red, each in his Maker's image." It is high time to reach out and give a helping hand to each other . . .

W. Deininger.
Puerta La Laguna,
El Salvador

Important Notice

Readers are reminded that Natural History is not published during July and August. Those who expect to be away after September 1, however, and wish to have their September issue sent to a temporary summer address are requested to notify the Membership Secretary. Please give also the date of expected return to permanent address.

° ° °

Sirs:

I have read with interest that Natural History has been in existence 50 years. I send you my best congratulations and most respectful greetings. If men studied nature profoundly, we would have no wars and would praise God for his ingenious works . . .

Eduard Espenshied.
Ludwigsburg, Germany

° ° °

Sirs:

. . . Your splendid editorial, "It's for You to Choose," . . . is an excellent presentation and very thought-provoking.

Irving M. Ives,
Senator from New York
Washington, D. C.

° ° °

Sirs:

. . . As a member of the Museum for many years, I take pleasure in congratulating you on the Fiftieth Anniversary of your excellent publication . . . I think that your editorial "It's for You to Choose" was one of the finest things I have read in my life, and of course I am saving it . . .

Anthony V. Ragusin, *Sec.*
Biloxi Chamber of Commerce
Biloxi, Miss.

The Planetarium Show

"Color in the Sky" will be the subject at the Hayden Planetarium during June. The presentation will include the northern lights, rainbow coloration, and related phenomena.

During July and August, visitors to the Planetarium will take an imaginary trip to the Moon by space ship. Landing in a lunar crater, the audience will explore its many strange wonders and view the earth from a new point of perspective in space.

Special Exhibits at the American Museum

Until June 16

Second Annual Exhibition of The New York Entomological Society.

June 9—July 4

Design Down Under

An exhibition comprising 22 photo mural panels dealing exclusively with the art and design of the Australian aborigines. Shields, bark paintings, tattooing, baskets, flint knives, axes, clubs, bull-roarers, sacred stones, paddles, and headdresses are some of the many kinds of designs shown.

June 15—July 30

National Soap Sculpture Exhibition

July 7—July 31

Old Flower Prints

A collection of old botanical prints assembled by Kennedy and Co.

September **NATURAL HISTORY** *1950*

NATURAL HISTORY

South Africa's "Missing Links" • Cortes • Spoonbill

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Now Ready!

AUGUST ON FIRE ISLAND BEACH

BY ROBERT CUSHMAN MURPHY

(*author of* LOGBOOK FOR GRACE)

This new enlarged edition was published again by popular demand. Dr. Murphy combines an effortless style, grace of manner, and sympathetic understanding of natural history in all its relational aspects. Among other subjects, the author discusses:

Point o' Woods

Its unique charm and simplicity almost within the shadow of Manhattan's skyscrapers.

Beetles and Biters

The insect population on Fire Island with emphasis on tiger beetles and stable flies.

The Turbulent Life of the Sand Bug

Being an interesting history of the life and times of *Emerita talpoida.*

Dr. Murphy concludes with a plea to save Fire Island and other untouched primitive territories so that city folk can "dwell in the presence and appreciation of the beauty our ancestors found here."

You will be a richer person after reading

AUGUST ON FIRE ISLAND BEACH

Science Guide No. 134 *Price, 40¢ plus 5¢ postage*

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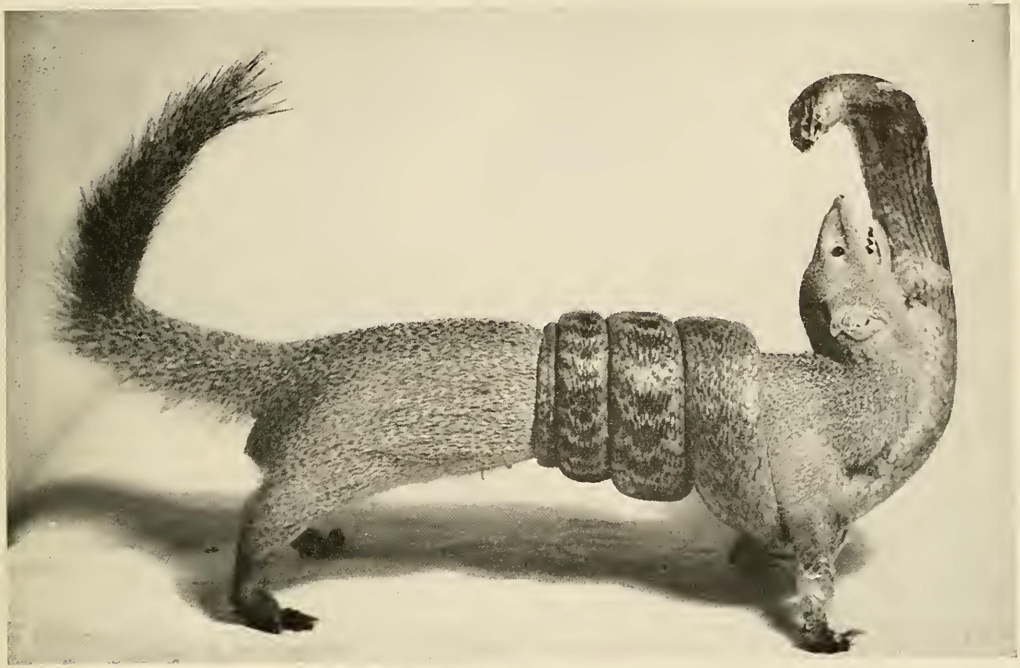
LETTERS



The Mongoose and the Cobra

Sirs:

I would like to know whether the pose depicted in this photograph of a mounted mongoose and spectacled cobra could ever happen in real life. This exhibit is in our Quaker Hill Museum of Natural History at Pawling, New York, and I have seen published photographs of at least one other similar mounting. As the cobra is a poisonous snake, why should it wrap itself around the mongoose? And how could the mongoose be standing firmly on its feet with a snake wrapped around its middle? I suspect that these specimens are the product of an imaginative taxidermist.

Also, what is the plural of mongoose? And is the mongoose always victorious?

Mrs. R. M. Gunnison.
Pawling, New York.

The following answer is offered by Charles M. Bogert of the American Museum's Department of Amphibians and Reptiles:

Mrs. Gunnison's comments on this mounting are quite to the point. I have seen a similar picture elsewhere, in which the snake's neck was firmly grasped in the mouth of the mongoose. The caption read, "Victorious mongoose polishes off a cobra," but the photographer had quite obviously trained his camera on a mounted specimen.

In the course of combat, a coil or so of the cobra may accidentally be wound around the body of the mongoose. Indeed, one of Dr. Thomas Barbour's photographs in his interesting little book, *Reptiles and Amphibians, their Habits and Adaptations,* depicts the live mongoose lying on its side with two coils of the cobra encircling it, one near the legs and the other near the head. Even were the cobra a constrictor, it would be unusual, to say the least, for it to wrap four or five coils around an attacker. Boas, bullsnakes, and kingsnakes that kill by constriction rarely employ more than two or three, and the hind part of the body and the tail are not ordinarily wrapped around an adversary. The positions of the snake and the mongoose in the photograph must therefore be attributed to the fanciful but misguided notions of the taxidermist.

The mongoose may kill an occasional cobra, but it does not seek out such prey. It devours birds, their eggs, lizards, and insects. While he was in China, Clifford Pope tested the behavior of the mongoose and the cobra on two occasions. Once he used a five-foot snake and a small mongoose, and later a three-foot cobra and a large mongoose. When placed together in a small room, each animal apparently regarded its opponent with considerable caution, concentrating its attention on the other. In both tests, the mongoose attacked the cobra at the moment it struck, biting at the snake's open mouth. The jaws of the two were repeatedly interlocked, although the mongoose sometimes avoided the relatively slow strike of the cobra by merely shifting its head.

The small mongoose failed to kill its enemy. However, Mr. Pope knew that the mongoose was in a weakened condition when brought to him, and it died the second day after the fight. The larger mongoose killed the smaller of the two cobras and showed no ill effects from the encounter. During the combat it repeatedly approached the cobra and then lay on its side just beyond its reach. In this position, it kept its vision fixed on the snake, raising its head from time to time to keep it in view—"a most peculiar and inexplicable behavior," as Mr. Pope remarked.

Is the mongoose always victorious? Under some conditions in captivity it obviously is not. In its native habitat, it probably does not often attack an animal it cannot subdue. On occasion, an acute hunger drive may lead it to abandon its normal caution. But most animals, whether from learning or instinctively, are not ordinarily prone to attack the sort of prey that cannot be overcome. Mistakes are doubtless made, however.

The plural is "mongooses," not "mongeese." These animals belong to an Old World family related to the weasels, badgers, and skunks. What is usually spoken of as the common mongoose inhabits southeastern Asia, from southern China to India. Closely related animals are of widespread occurrence in Africa, and some of these are called mongooses. Incidentally, it may be added that, owing to their destruction of game and poultry, a law has been passed many years ago prohibiting the importation of live mongooses into the United States.

Can Birds Tell Time?

Sirs:

I wonder if the English sparrows in my city garden have a sense of time. About a year ago, I discovered that they like to eat rice. Since then, I have scattered a small amount of rice grains just outside my kitchen door each day around noon. While at other times I occasionally see a single sparrow hopefully searching in the feeding area, there is a distinct difference at noon. Then, as I look from the window, there are always several sparrows watching near by, apparently aware that it is feeding time. There is a restless excitement and expectancy among them. At the sound of the kitchen door opening, they all fly a little farther away, but as soon as I have put out the food and entered the house, a dozen or more return immediately and begin feeding eagerly. In a short while the feast is over, and the entire flock flies away until the next day near noon, when the performance is repeated.

Can birds tell time?

Henrietta Schroeder.

Woodhaven, N. Y.

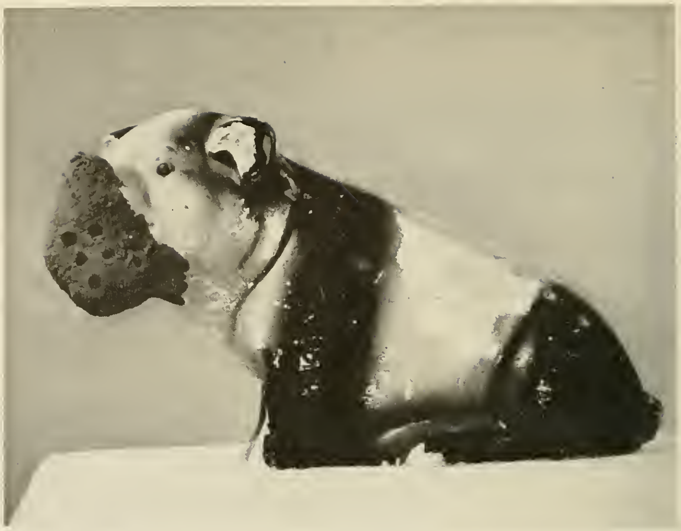
The following comments are offered by Dr. John T. Zimmer, Curator of the Department of Birds at the American Museum:

There is little doubt that birds have what, for want of a better term, may be called a sense of time that can operate to induce some particular action at a certain point in a daily rhythm. Many of a bird's activities are governed by such automatic trigger mechanism. A rhythm is established in which various related activities follow each other in regular order. Each completed stage presents a new stimulus that releases the following reaction until the cycle is completed. If the order is broken or interrupted, the bird may be quite confused, perhaps perform some useless action whose normal stimulus is suggested by the situation, or perhaps go back and start over. This type of behavior is particularly noticeable in the activities of feeding the young, where the same maneuver is repeated at frequent intervals. These do not, however, necessarily involve any fixed time of performance.

Other activities may, on the other hand, have a fixed time-release. A tropical wren was recorded as beginning its morning song at a relatively fixed time, and although the intensity of light may have had some influence on the release, it was far from governing the action. Again, a male pigeon has been reported as accustomed to relieve his mate at the nest at ten o'clock each morning. The habit was so fixed that when the female was killed by a cat the male neglected the young (which consequently died from exposure) until his scheduled hour the following day.

The sparrows were, in effect, trained to being fed at a particular time of day, and an internal rhythm had become established with reference to food at that period in the day's activities. Whatever the internal mechanism may be that would spring the alarm, when the signal was given, the proper action followed quite automatically.

There is a nice opportunity for someone to make a detailed study of timing by birds, and the results would be of considerable interest. As far as I know, no one has yet concentrated on the problem.



A Lesson for the Laggard

Sirs:

The accompanying picture shows an unusual-looking animal that I discovered on a shelf in my garage. The little pig had been tucked away on the shelf for some time, and you can imagine my consternation when I first glimpsed the decorations that had been added by a mud-making wasp.

Tulsa, Okla. Laura M. Clark.

Suet-storing Nuthatches

Sirs:

Last winter we became much interested in observing a White-breasted Nuthatch that had been coming to the crotch of a sugar maple tree next to our house where we had been placing a piece of suet. On New Year's morning, we noticed that the Nuthatch was picking into the suet quite freely, and when it had a full beak, it would deposit this

Continued on page 336

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The Magazine of the American Museum of Natural History

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VOLUME LIX—NO. 7 **SEPTEMBER, 1950**

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THE COVER THIS MONTH

The Tarascan village of Angahuan is now the nearest populated community to Mexico's new volcano Parícutin. The wooden homes with their steep shingle roofs are typical of the region. The people are a happy, friendly lot, whose co-operation has gone far toward making the joint Mexican-American study of the volcano a success. For the little girls, the burdens of motherhood begin as soon as they are big enough to carry little brother or sister in the *reboza,* which is the usual attire of Mexican girls and women.

The people of Angahuan have been hard hit by the eruptions of the young volcano. Repeated ash falls have smothered the crops in the fields and killed the grass on which the cattle grazed. Though unspectacular, their plight is serious. Cultivation of the slopes from which the ash has already been washed is only hastening the day when further erosion will make it no longer possible to raise food near the village. While they would undoubtedly cling to their homes as vigorously as did the residents of San Juan and Parícutin, resettlement may ultimately be their only solution.

Frederick H. Pough

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By
JOHN L. LACEY

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BRAZILIAN CULTURE

- - - - by Fernando de Azuevedo

The Macmillan Co., $12.50
562 pp., 418 illusts.

IN this era of overworked superlatives, the adjective "monumental" is unquestionably employed too loosely and too often. Yet no other word seems suitable to describe this vast compilation of Brazilian culture history. First published in Portuguese, in 1943, as the introductory volume to the 1940 Brazilian census, the study is conceived on a grand scale and executed with admirable scholarship.

The book is divided into three parts: (1) the Factors of Culture—the environmental and human setting; (2) Culture—the Brazilian achievement; (3) The Transmission of Culture—the history of, and current trends in, education in Brazil. Although the author—a noted sociologist and educator—is thoroughly familiar with the accepted and all-inclusive anthropological concept of culture, he prefers to employ the term in its classic, restricted sense as applying to "refinements of intelligence." In essence, therefore, the book is a study of the origin, growth, and change of intellectual values, ideas, arts, and scientific achievement in Brazil. Only incidentally is it concerned with the material aspects of Brazilian economics and technology.

Following the French sociologists, it is the author's contention that the "genius" of a people receives its fullest expression through its educational system. A third of the book is thus devoted to a historical analysis of Brazilian education as a key to an understanding of the Brazilian "collective character."

Although certain portions of the study seem thin, the author evidences a keen sense of history as well as a tolerant awareness of the multiplicity of factors operative in cultural evolution. All things considered, the book should prove an indispensable addition to any library dealing with the peoples and cultures of Latin America, and it is likely to remain one of the most significant syntheses in the field of Brazilian culture history for many years to come. The illustrations are fascinating for their number and variety, and the index is excellent.

HARRY TSCHOPIK, JR.

THE COMING OF THE MAORI

- - - - - - - - - by Sir Peter Buck
(Te Rangi Hiroa)

Whitcombe and Tombs, Christchurch, New Zealand, 30/, 542 pp., 24 plates

IN this massive book Sir Peter Buck brings to a climax a lifetime of research, which began in a loving exploration of the culture of his mother's people and extended into many other Polynesian cultures. Sir Peter's work has always been distinguished by the liveliness and humanity which he was able to bring to the details of basket making or mat making, fishing or housebuilding. The material aspects are traced with the greatest accuracy and detail, but they are always accompanied by comment on their meaning in the lives of those who weave and fish and build. This interest in material culture has been paralleled by a deep appreciation of the poetry and mythology of the Polynesians. Taken together, the details of technology and the romance of long voyages, the final settlement and faithful preservation of the records make an impressive work, combining scholarship, field work, historical passion, and sensitive insights into one of the most fascinating groups of people of which we have any knowledge—the Maori of New Zealand.

MARGARET MEAD

OUT OF MY LATER YEARS

- - - - - - - - by Albert Einstein

Philosophical Library, $4.75
290 pp.

ALTHOUGH the pieces that make up this book were written at various times and for various occasions, they have an unexpected unity and cohesion which the range of subject matter would not at first suggest. Many of them are less than a page long, few are more than five or six; they cover personal, scientific, social, political, and biographical matters, and the final section deals with a subject close to Einstein's heart—the Jews. Yet, from this apparently formless assemblage of exhortation, analysis, and comment, there emerges the unifying impression of a human portrait—a self-portrait. For out of the reading of Einstein's reactions to the world of science and to the affairs of men, the reader builds up a picture of Einstein himself that shines forth and grows in luminosity as one continues to read.

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Einstein's deep faith in tolerance expresses itself again and again in pleas for an acceptance of human differences. Let our children grow up free to express their creative urges most fully, and let us cheerfully and willingly permit nations and groups to develop in their own way.

To those who think of Einstein as an austere and remote mathematician, this book will reveal a warmer, more human person. Here is a wise, gentle, firm man who has thought hard about the human predicament and has much sage advice to give.

HARRY L. SHAPIRO

YANKEE'S WANDER WORLD

Circling the Globe in the Brigantine Yankee

- - - - by Irving and Electa Johnson

W. W. Norton and Company, $5.00.
277 pp., 21 full-color photographs,
58 black-and-white.

TO circle our globe by plane is costly and not very educational. The Johnsons have a better method; they make it possible for their fortunate companions to visit places inaccessible by plane or steamer. These sea-going educators have a ship both beautiful and practical; the crew learns as it goes. What experience they gain in 18 months! What strange places and peoples they visit!

Commander Johnson devotes one chapter to this new *Yankee,* a 96-foot brigantine with auxiliary Diesel engines, and 7,775 square feet of canvas. His wife contributes many of the other chapters about their fourth cruise around the world. Merely to pick a congenial crew required rare insight. The first mate must be a competent officer; a doctor and a good cook were essential. In addition there were about ten young men of varied tastes and skills, age around 20 preferred, and four young women not much older. The Johnsons' sons have been seafarers since babyhood.

The *Yankee* set out from Gloucester early in November, 1947, and a very brief sampling of her stopping places includes Haiti, the Galápagos, Easter Island, Pitcairn, the Tuamotus, Tin Can Island, the New Hebrides, New Guinea, Bali, Keeling Cocos, Zanzibar, St. Helena, and Devil's Island. From the coasts of South America, Asia, and Africa, trips were made into the interior. Old friends were encountered in odd places, many new friendships formed.

At Pitcairn the Johnsons are loved and admired. The Governor of St. Helena proved to be an old friend from the New Hebrides. Commander Johnson's war service aided greatly; he knows the places best suited for study. Through days fair or foul, and some serious storms, the *Yankee* sailed on with its crew of enthusiasts. Knowing the Johnsons will show you why. This admirable book, beautifully illustrated, cannot be too highly commended.

James P. Chapin

FISHPONDS AND AQUARIUMS

- - - - - - - - - - by Ian Harman

Sidgwick and Jackson, Ltd.,
44 Museum St., London, England
128 pp., 33 illusts., 6/

THE author of this small book writes well and apparently has had a good deal of firsthand experience with fishponds and home aquaria for goldfish and other inhabitants of temperate water. He also possesses the ability to organize his material and present it in logical sequence. But no man should suppose that he knows nearly everything about any field of endeavor, and although Mr. Harman undoubtedly would be the first to agree with this dictum, his book unfortunately seems to indicate this kind of overconfidence—or else a lack of appreciation of the host of errors that inevitably creep into the best of factual manuscripts.

His book is marred by entirely too many small misstatements of fact and orthographic errors—mistakes that could have been eliminated had any wide-awake biologist checked the work. Why do so many popular books show such disregard for the virtue of accuracy? The final responsibility surely lies as much with the publisher as with the author.

With most of the practices and techniques outlined here one would have no quarrel. A few, however, are quite contrary to this reviewer's experience: charcoal has little, if any, effect on the gas content of water and therefore can serve little purpose in a pool or aquarium; breaking the ice over a garden pool is a dangerous practice and hardly ever necessary to avoid smothering the fish; feeding as often as twice a day almost inevitably leads to overfeeding with all its concomitant evils; plants do not oxygenate the water in small pools or aquaria to any appreciable extent and are thus not essential for aeration.

This is, by and large, a satisfactory but undistinguished addition to the growing literature on fishponds and aquaria.

James W. Atz

A BIRD PHOTOGRAPHER IN INDIA

- - - - - - - by E. H. N. Lowther

Oxford University Press, $5.50
162 pp., 79 plates

FOR 34 years Mr. Lowther has been photographing and taking notes on India's rich and varied bird life. From time to time some of the results were published in the *Journal of the Bombay Natural History Society,* but this serial publication is not readily available, and they are republished here, revised and in greatly augmented form. Half of the illustrations are new.

This book is not just another of those beautiful albums of beautiful bird portraits presenting mostly common species. It has much more merit. In addition to the photographs, of which there are 151 depicting 114 species, the text gives much valuable information on nests, eggs, courtship, food and feeding, and other behavior. Many of the birds at their nests had never been photographed or shown before. All the pictures are valuable, and many of them are striking. The reader may not realize that all this was obtained the hard way. In the region covered (parts of Bengal, Bihar, and the United Provinces) and at the season these pictures and observations were made, the temperature reaches 140 degrees F. The conditions in a cramped and stuffy blind must have been appalling.

This reviewer has but one regret—that in a book of definite value such as this one, scientific names are used but once. This, however, detracts in no sense from

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the popular appeal of the book which, as the jacket claims—for once too modestly, it seems—"is possibly the best collection of Indian bird photographs so far assembled in any book."

Charles Vaurie

Plant disease handbook

- - - - - - - by Cynthia Westcott

D. Van Nostrand Company, $7.50
746 pp., 111 figs.

HERE is the book for which those of us with small home gardens have been waiting! It is a splendid compendium of 1500 diseases of 1000 common native and introduced trees, shrubs, vines, grasses, garden flowers, and vegetables grown in home gardens, orchards, parks, and parkways anywhere in the United States. Each disease is described, and control measures are discussed. There are elaborate indices of the diseases and their causal organisms; the host-plants are listed with cross references to all the diseases known to attack each plant, and so are the garden chemicals and commercial products used in the treatment of plant diseases. There is even a very gratifyingly up-to-date classification of the pathogens. In the section in which all the diseases known to attack a given host are listed, the distribution of the disease over the country is indicated by the names of the states in which it has been found or by such terms as "general," "widespread," "occasional," etc.

In order to keep the book small enough and sufficiently reasonable in price for the ordinary garden, orchard, or greenhouse owner, the diseases of field crops (such as wheat, rye, oats, barley, rice, and cotton) have been omitted, but corn and the various vegetables likely to be found in small gardens are included. There are 111 excellent photographs and drawings to illustrate the well-written text. The typography and format are excellent for easy readability and quick reference. A selected bibliography of 135 of the most important books, pamphlets, and articles on the subject is included, and the text is filled with suggestions as to where the reader may obtain more information.

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This is by far the best book this reviewer has yet seen for the quick detection of diseases caused by bacteria, fungi, viruses, nematodes, and nutrient deficiencies, and their control.

H. N. Moldenke

Popol Vuh The Sacred Book of the Ancient Quiché Maya English version by Delia Goetz and Sylvanus G. Morley from the Spanish translation by Adrián Recinos

University of Oklahoma Press
Norman, Okla., $3.75, 267 pp.

THE *Popol Vuh* is one of the best of the written documents to have come down to us from pre-Columbian America. It is the sacred book of the Quiché Maya, a large and important branch of the Maya who lived in the highlands of Guatemala but who shared in the unsurpassed civilizational achievements of the lowland groups. Concerning the mythology and traditional history of the Quiché (the creation of the earth and of man, the history of the gods and of the rulers of the Quiché nation), it is a completely native chronicle expressing with apparent fidelity the mode of thought of this advanced American Indian people.

Although the *Popol Vuh* has been widely known for many years through various published editions in Spanish, French, and German, this is, surprisingly enough, the first complete edition in English. Translated from the recent Spanish language edition prepared by the Guatemalan scholar Adrián Recinos, it is most adequately documented with footnotes and with an excellent introduction concerning primarily the history of the document from the time when it was first written down in the Quiché language, but in Latin script, at about the middle of the sixteenth century.

This fine English edition of the *Popol Vuh* should be welcomed by all those interested in the history and philosophy of the American Indian civilizations who have been obliged to wait for an English translation.

Gordon F. Ekholm

Early man in the new world

- - - - - - by Kenneth Macgowan

The Macmillan Company, $5.00
260 pp.

THE history of man and culture in the New World falls into two conventional halves—the earlier Indian phase and the post-Columbian European phase. The reconstruction of the prehistory of America has been a long, arduous, and often exciting adventure. And no part of that enterprise has been more controversial than the problem of dating the first settlement of man in the New World, the origin of pre-Columbian populations, and the existence of cultural influences from the Old World. Opinions on these subjects have undergone radical revision periodically. We are now, as a result of a long series of recent discoveries, in such a season of re-evaluation. With the bars down, speculation has tended to run riot, and some of the fanciful ideas generated by this new freedom can only be taken as by-products of a silly season.

Fortunately, Mr. Macgowan has written in *Early Man in the New World* an excellent introduction to the whole subject, assembling most of the significant evidence, presenting the various and often contradictory deductions, and maintaining, on the whole, a well-balanced attitude toward the competing claims.

In general, Mr. Macgowan's position on many controversial points seems to be a little left of center. He accepts Hooton's and Gladwin's hypothesis that an Australoid or Melanesoid strain antedated the more classic Mongoloid Indian in America. He is significantly open-minded to evidence suggesting trans-Pacific influences on native culture; and, although guarded on dating these early migrations, he is not hostile to the opinions that would place these events further back than the end of the last glaciation.

Harry L. Shapiro

Introducing the insect

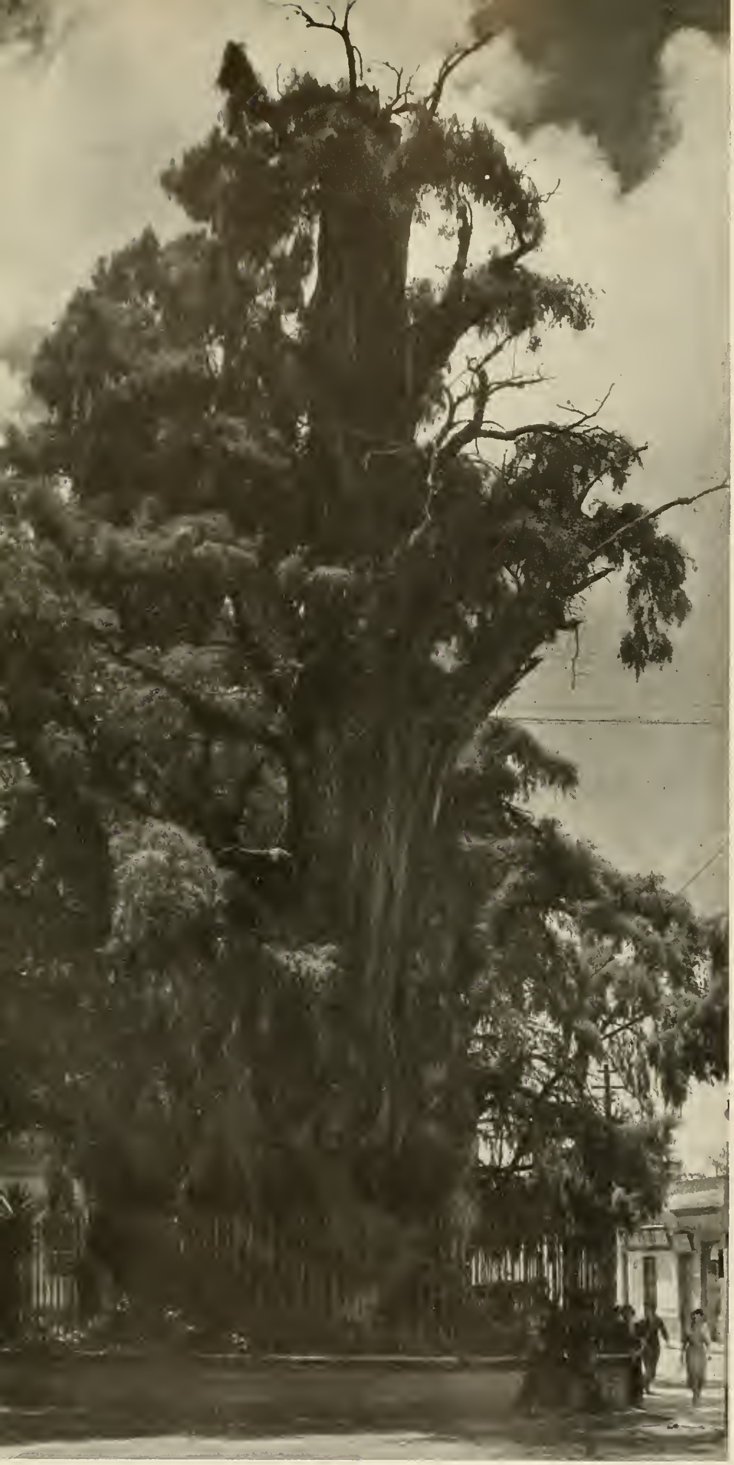
- - - - - - - - - by F. A. Urquhart

Henry Holt and Company, $5.00
287 pp., 160 figs., 4 color plates

BECAUSE of the enormous number of different kinds of insects, anyone who attempts to introduce them to the general public can do so only in a sketchy manner. He must select those that are most often seen by the public or that have an unusual appeal because of unusual habits. It is always difficult to select the most suitable examples because different kinds of insects are found in different parts of the country.

Dr. Urquhart has selected types that are very widely distributed in North America, and many of these occur also in Europe and other parts of the world. He has prepared simple, illustrated keys to the orders and to the families of the larger orders, such as the bugs, beetles, bees and wasps, butterflies and moths, and the true flies. Because of lack of space, a few of the less important orders and many families are necessarily omitted. The chapter on making a collection from the beginning to the completion of preparation for scientific study or exhibition will be found most helpful, while the chapter on anatomy and life history

Continued on page 334



▲ A BATTERED SURVIVOR of five centuries of history: the "Tree of the Sorrowful Night." Under this tree, in 1520, Cortes mourned the most crushing defeat sustained by the Spanish in the New World

"Tree of

IN a crowded suburb of Mexico City, in the thick of the clangor and uproar of a great metropolis, stands a gnarled, broken old monster of a tree that gives every evidence of having as many lives as a nimble-witted cat. More lives, in fact; for who ever heard of a cat living upward of 500 years? This battered veteran of the centuries is intimately associated with the history of the Spanish conquest of Mexico, and it bears the melancholy title of "Tree of the Sorrowful Night."

The years have dealt harshly with the tree. Its crown is gone, its branches are splintered, its interior is as hollow as a smokestack—so hollow, in fact, that another tree grows within the main trunk. Yet this gutted giant clings grimly to life, putting forth new leaves and greeting each succeeding spring like an inspired pillar of faith.

The legend that gives the tree its doleful nickname is one of the most colorful in Mexican history. Hernando Cortes paused under the tree during his withdrawal from Mexico City in 1520 and wept for the blow fate had dealt him. Half of his army had been lost in the battle. Gone were all the guns and most of the treasure. Cortes, who had labored for hours to keep the retreat from turning into a rout, sat under the great cypress weeping for the dead and for the loss of Mexico City.

Cortes' Mexican campaign had been a disastrous one. Although having forced themselves into the center of the city, Cortes and his army were unable to gain control of an increasingly hostile populace and decided to retreat to safer ground. Mexico City stood on an island in the center of a lake. It was reached from the mainland by an elaborate system of causeways and was protected by warriors on foot and in innumerable canoes. The solidly constructed causeways were wide enough for several horsemen to ride

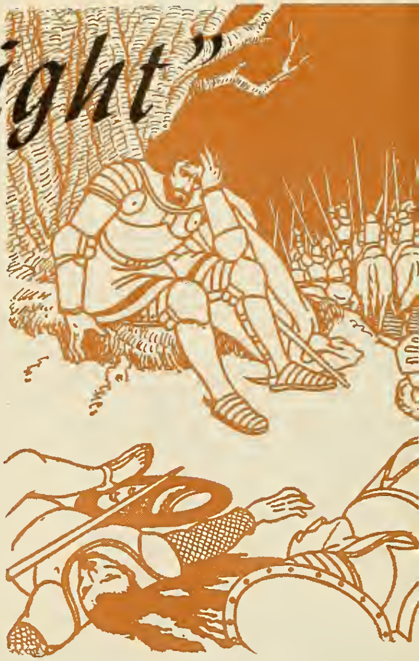
the Sorrowful Night"

An ancient patriarch that saw a conqueror weep
and lived to symbolize his sadness

By Philip Ferry

abreast. With so many hazards surrounding their escape, the Spaniards were like rats fighting their way out of a trap.

The Spaniards planned to evacuate their position under cover of darkness, and at midnight on June 30, 1520, they began the soul-breaking march from Mexico City—"the scene of so much suffering and such indomitable courage," as Prescott phrased it. Each soldier carried as much gold as he could; Cortes and his captains took the lead, followed by the squadrons carrying treasure and baggage. As the Spaniards reached an open breach in the causeway and were in the act of laying a portable bridge across the gap, they were discovered by the sentinels.



From Alfonso Teja Zabre's
Guide to the History of Mexico, Mexico, 1935

▼ "Tree of Tule"—the oldest, largest, and most celebrated tree in Mexico. Some Montezuma cypresses are said to be at least 3000 years old and are obviously the remnants of a great tropical forest that once covered the valley of Mexico

hoto by Kodak Mexicano Ltd.

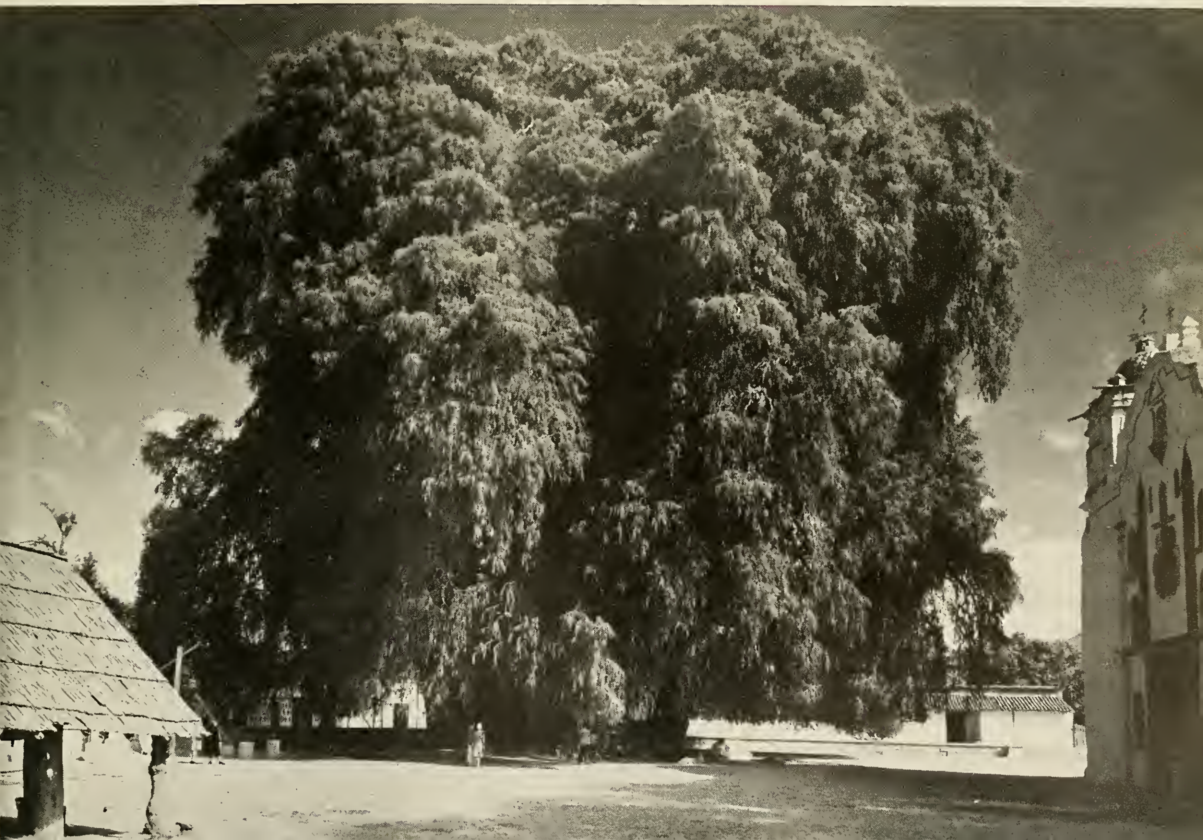


Photo by Cia Mexicana de Aviacion

▲ **Typical Mexican street scene.** In many parts of sunny Mexico the Montezuma cypress is sought as a shade tree

The alarm was sounded, the city was roused, and thousands of vengeful Aztecs came swarming over lake and causeway.

The Spaniards were set upon from all sides. The battle raged the length of the causeway, the breach being soon filled with equipment and the bodies of men and horses. The fighting continued throughout the night, the hard-pressed Spaniards battling desperately like cornered animals. With dawn, the survivors managed to fight their way to the mainland. As they streamed by and rallied on a slight rise to the west of the city, the exhausted commander dismounted and gazed sorrowfully on the broken remnants of his army.

What a sad spectacle they presented! Gone was the treasure and hundreds of their comrades. The exhausted cavalry, most of them afoot, dragged themselves wearily along, their shining armor battered, their elaborate raiment and crests dripping with water, their proud banners gone. Cortes looked at his thinned and disordered ranks. Though accustomed to control his emotions, the sight was too much for him. Covering his face with his hands, he gave way to tears.

It was the worst defeat sustained by Spanish arms in the New World. That night of disaster, which took half of Cortes' army, was branded "La Noche Triste" (The Sad, or Melancholy, Night), while the tree that was the scene of his sorrow became similarly known as El Arbol (The Tree) de la Noche Triste.

This tree under which Cortes bemoaned his unhappy fate (although a year later he was to succeed in reducing the city) was a giant Ahuehuete, as the Mexicans call it, or Montezuma Cypress as it is also known (*Taxodium mucronatum*, the *Cupressus disticha* of Linnaeus). It belongs to a family of conifers and is related to the deciduous American bald cypress in the United States. Appropriately enough, the tree has always been a symbol of mourning and sadness. In ancient times its branches were used at funerals and to adorn tombs.

Because of the tendency of the branches to spread horizontally, the tree has always been sought for its shade. In the even climate of the Mexican highlands the species attains great age, with a tremendous over-all spread of branches and enormous size, as is evidenced by some of the specimens in the forest of Chapultepec Park in Mexico City. Perhaps 200 of the old ahuehuetes remain in the park. Some are declared to be at least 3000 years old and are obviously the remnants of a magnificent tropical forest that once covered the great valley of Mexico.

Although the trunks of some of the trees are enormous—the Montezuma Tree, largest in the park, has a circumference of 45 feet—decay has eaten into the heart of many of the patriarchs. In this respect, the ahuehuete seems to lack the invulnerability of California's sequoias, which are capable of living not only

centuries but millenniums without decay.

The Tree of the Sorrowful Night is one of the largest ahuehuetes known. I stepped off the circumference of the tree and estimated the girth to be something over 60 feet, which would give it a diameter of around 20 feet—a giant by any standards. Even in Cortes' day it was a wide-branched centenarian offering welcome shade to a good-sized detachment.

Cortes seems to have had a special fondness for these giant cypresses, and there are three associated with his name. During the early days of his advance from the Atlantic coast to the valley of Mexico, he stopped at the Indian village of Tlatlauquitepec and remained several days to rest and refresh his troops. Modern Indians have long pointed out the venerable *Arbol Grande* to whose branches the Conqueror hitched his horse.

The third of the giant cypresses connected at least in legend with Cortes' Mexican campaigns is today the oldest, largest, and most celebrated tree in Mexico. It is the great Tree of Tule, or Arbol del Tule, as the Mexicans call it, a giant cypress standing in the churchyard of Santa Maria del Tule (Holy Mary of the Bulrushes) about six miles from the city of Oaxaca, in southern Mexico.*

Cortes has been dead these 400 years, having flashed through Aztec history like a thunderbolt across a summer sky. The great ahuehuetes that marked his advance in the New World still flourish. Coursing through the fibers of these indomitable patriarchs seems to be some of the iron that flowed through the veins of Cortes. Where the Spaniard conquered a people, these trees have prevailed over time—a vastly greater achievement.

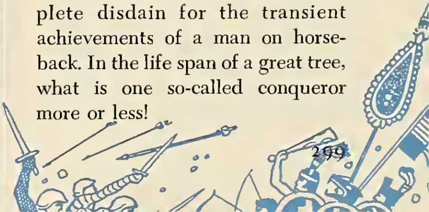
The Tree of the Sorrowful Night has shown in its resistance to time the same hardihood and unyielding stubbornness that Cortes displayed in the face of repeated disaster. Fanatical Indians attempted to burn it three-quarters of a century ago. As a result, it is so hollow that one wonders what keeps it upright. Actually, it is a mere shell. Patched and wired like an ancient Model-T Ford, it looks as if it would prove an easy victim to one of the strong winds that sweep across the plain of Mexico. Yet it goes on living, providing welcome shade for the picturesquely costumed peons who seek the shelter of its spreading branches and massive trunk.

▼ **Like sentinels** at the gate, these cypresses seem to guard the slumber of the mighty volcano Popocatepetl

In recent years science has come to its rescue with the latest advances in tree surgery. By removing the dead matter from the interior and plugging many of the worst holes with concrete, by painting the open wounds with a veneer of preservative and by stopping up many of the gapping holes in the lower trunk, it is hoped that the noble old veteran's days will be prolonged.

Today the Tree of the Sorrowful Night forms the central feature of a tiny neighborhood park in Mexico City, and all commercial tours of the city include a visit to the tree. Children crawl over the knobby body, swing on the gnarled protuberances, and run in and out of the gutted interior. Surrounded with all the hubbub of a large city, hemmed in by a few square feet of greensward, and identified incompletely by a sign that now carries only the single word *Arbol*, it looks exactly what it is: a survivor of the past and a memento of a time when the great plain of Mexico echoed to the tread of mailed conquerors.

One cannot say that history retains any particular veneration for the memory of Cortes or special glory for his dubious achievements; but history can have nothing but admiration for a weather-beaten, gutted old patriarch of a tree that goes on living and sending out green leaves like any lusty young seedling. The natives know Cortes only as a legend; they live intimately with this giant cypress that bears its years and fame with a dignity signifying complete disdain for the transient achievements of a man on horseback. In the life span of a great tree, what is one so-called conqueror more or less!



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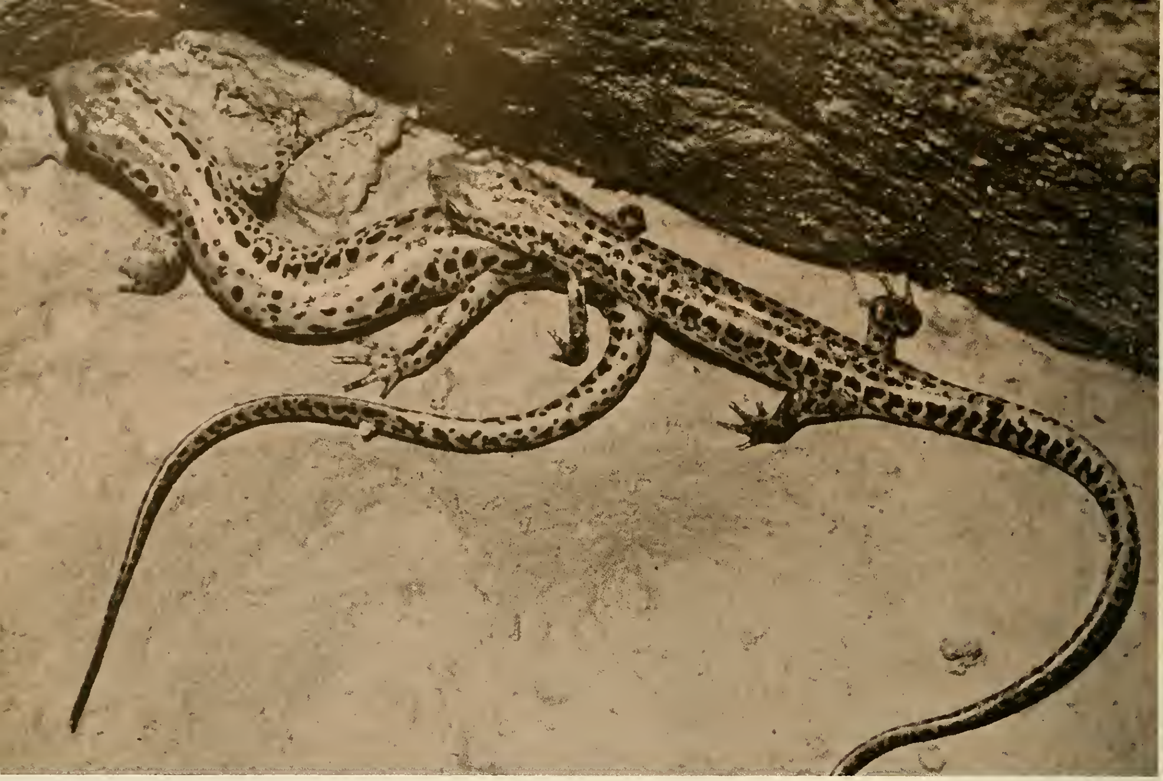
*See "A Methuselah among Trees," by Walter Henricks Hodge, Natural History for May, 1948



Charles E. Mohr photo

▲ THE TAIL AMOUNTS TO about 60 per cent of the total length of the long-tailed salamander, *Eurycea longicauda.* Most salamanders of this genus perform an elaborate courtship ritual. The male massages the female's chin with the top of his tail, as shown here

LUNGLESS *Salamanders*

For centuries it was not realized that many of our familiar salamanders live without lungs or gills

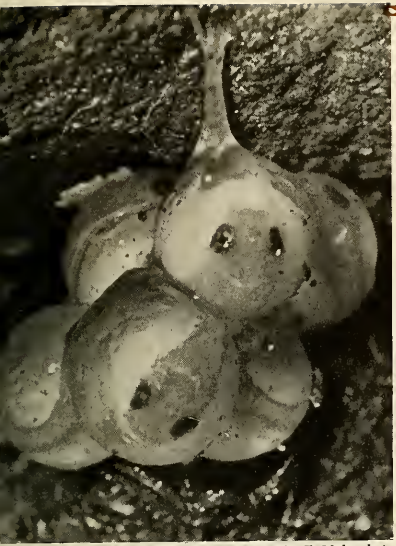
By ROMEO MANSUETI

THE year 1894 is not famous for extraordinary events, but a small group of zoologists may recall it for the minor sensation caused by a fellow-worker, Professor H. H. Wilder, of Smith College in Northampton, Mass., exploded the bomb by announcing in the staid periodical *Anatomischer Anzeiger* the discovery of "*Lunglose Salamandriden.*"

"Lungless salamanders" seemed such a curious phrase that a flurry of comment followed the announcement. Professor Wilder spoke of these four-footed, tailed amphibians as neither possessing gills nor lungs in the adult stage—a most unorthodox situation. Many biologists simply scoffed at the statement. Others wanted to know how their blood could be oxygenated. And amateur naturalists put the question simply: "How can the darn things breathe?"

Influential, erudite Professor Edward Drinker Cope, America's veteran comparative anatomist of that period, stated unequivocally that he had been dissecting salamanders most of his life and had always found lungs in them. Nonetheless, Cope's colleagues found that he was mistaken in the case of the salamanders of the large family Plethodontidae, all of which proved to be lungless.

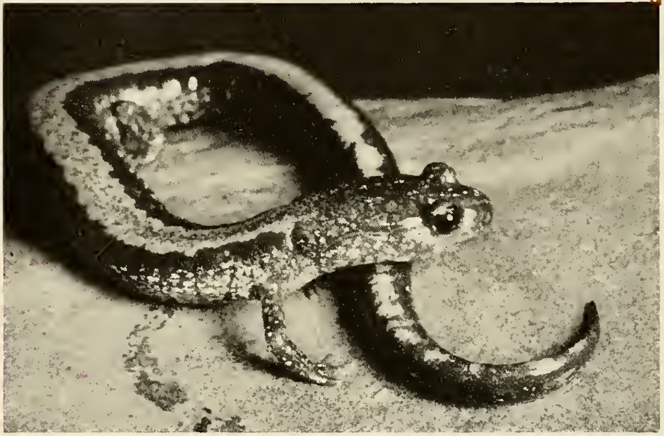
This important and very surprising fact had not been observed or suspected up to that time, although these animals had been studied by numerous investigators both in America and Europe. True, a German embryologist, Heinrich Rathke, had first noticed the absence of



Charles E. Mohr photo

◄ EGGS OF THE RED-BACKED SALAMANDER, *Plethodon cinereus.* The big dark eyes of the salamander embryos show clearly through the transparent gelatinous cases. The eggs are one-fifth inch in diameter, and after two months of incubation, the young, nearly an inch long, will emerge. These eggs are generally found in crevices in decaying logs, but this grapelike cluster was found suspended from the underside of a flat stone

▼ THE RED-BACKED SALAMANDER, *Plethodon cinereus,* which emerges from these eggs, lives completely away from the water and can withstand a great deal of dryness. It is a small salamander—only about half the size shown here



August Selckmann photo

lungs in the worm salamander, *Batrachoseps attenuatus,* as early as 1833. But it was Professor Wilder who first demonstrated that the lack of lungs was normal and widespread among these curious and colorful creatures. Even today, very few people imagine plethodontid salamanders as freaks of nature.

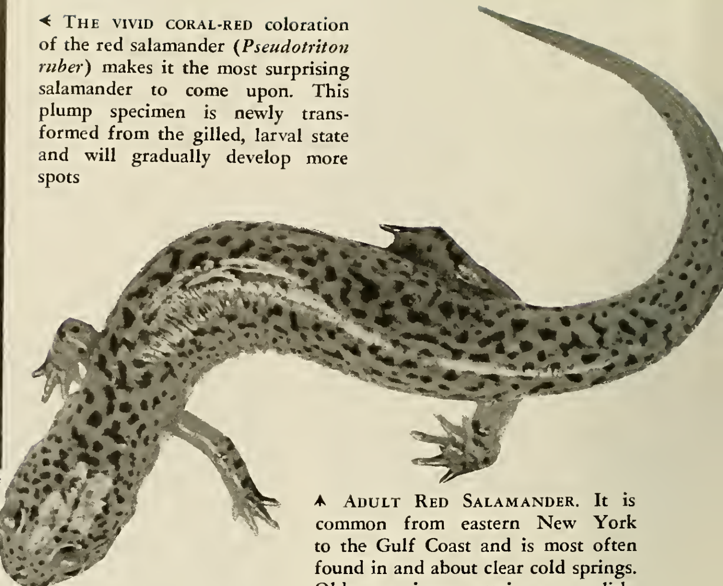
Elfs and goblins are the acknowledged but mythical inhabitants of the forest, but the plethodontid is the only genuine sprite of the woodland within reach of many naturalists. When discovered by the novice in its natural habitat, its smooth and shiny body, augmented by brilliant hues and striking patterns, gives the illusion of a jewel gleaming in the dull earth or mud. Delicate, as if created by the careful craftsmanship of a glassblower, these miniature amphibians are commonly found in springs, along streams, and even on land. To find them, one must overturn rocks and logs, plunge a hand into ice-cold springs, and suffer other inconveniences. Despite their apparent abundance, few people ever see them, for many are rather secretive and are apt to be clever escape artists.

Among the celebrities of this family of salamanders, the common red salamander, *Pseudotriton ruber,* is an excellent example of a brilliantly-colored species commonly found over most of the eastern United States. When uncovered from beneath a rock in a spring, it strikes one as being too startlingly vermilion to be a natural part of the countryside. On the other hand, its bright hues might easily frighten some nature lover who associates venomous qualities with such a gaudy creature. Of course, the red salamander is not poisonous; all plethodontids are perfectly harmless. Contrary to the principle that the coloration of most amphibians matches their surroundings fairly well, the red color of *Pseudotriton* seems to defy explanation on a basis of protection. Rather, these tints are like those of the leaves in autumn—beautiful but without value.

In the same class as the red salamanders, the long-tailed salamander, *Eurycea longicauda,* reigns almost as champion by having a record-length tail. The tail of an adult is about one and a half times the length of the fragile-looking body. But the very rare Alaska worm salamander, *Batrachoseps caudatus,* sports an even more splendid tail, which is almost twice the length of the body of the adult. The long-tailed salamander is yellowish-orange, with a series of black spots along the sides of the body. Adults are found mainly in and beneath old rotting logs and under flat rocks adjacent to streams. It is also a cave dweller. When a flashbeam plays upon it in such surroundings, it looks like some strange and beautiful specter.

Juvenile long-tailed salamanders and their relatives breathe by means of externally visible staghorn or bushy gills, the three branches arising from a common

◄ THE VIVID CORAL-RED coloration of the red salamander (*Pseudotriton ruber*) makes it the most surprising salamander to come upon. This plump specimen is newly transformed from the gilled, larval state and will gradually develop more spots



Charles E. Mohr photos

▲ ADULT RED SALAMANDER. It is common from eastern New York to the Gulf Coast and is most often found in and about clear cold springs. Older specimens attain a purplish-brown color, with numerous irregular spots. Adults average five inches in length

base. These merely lie exposed to water currents. The water bathes the many fine filaments, which are covered by delicate epidermal membranes that contain blood channels, and the exchange of oxygen and carbon-dioxide gas occurs between the blood and the water. Larval salamanders display aquatic adaptations before metamorphosis; but shortly before the pre-adult stage, the gills and fins atrophy and the dull larval hues change as if by magic to vivid colors. It is at this stage that plethodontid salamanders exhibit their peculiar anatomical individualism.

When the external gills disappear, normal "breathing" presumambly stops because of the absence of lungs. Plethodontids continue to "breathe" as adults, nevertheless, but in their own strange way. Even in other families of salamanders, the lungs are now considered to serve chiefly for regulating buoyancy rather than as respiratory organs. The utilization of certain marvelous breathing mechanisms compensates for such a great loss. First of all, plethodontids depend largely upon skin respiration. The blood is aerated through the very thin and constantly moist epidermis. Tiny blood vessels that penetrate to the surface of the skin carry on the vital oxygenation. Secondly, the lining of the mouth is very vascular and also serves as a respiratory organ.

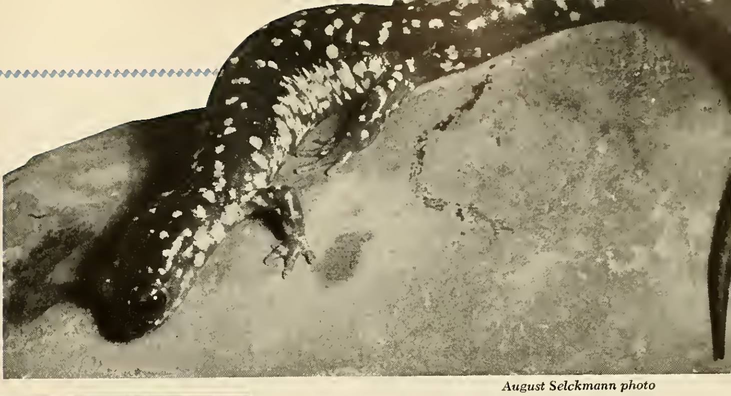
With such specialized structures for "gulping" or "sweating" for air, one might expect the activity of lungless salamanders to be restricted to imperceptible movements. On the contrary, most species are very active in their particular habitat. Some of the dusky salamanders of the genus *Desmognathus* are truly water acrobats when stirred.

Brooks are the "sanitariums" for many lungless salamanders. Swift-running, gushing streams are highly oxygenated, hence a perfect home for a lungless animal. Lungs having a hydrostatic function would obviously be of no particular advantage in swift currents, so their loss in that sense is no sacrifice.

All amphibians are cold-blooded, including, of course, the plethodontids, but they do not suffer in their cold aquatic environment. Bitter-cold water in winter and anything short of freezing cannot lull the salamanders into hibernation. Many are active all winter.

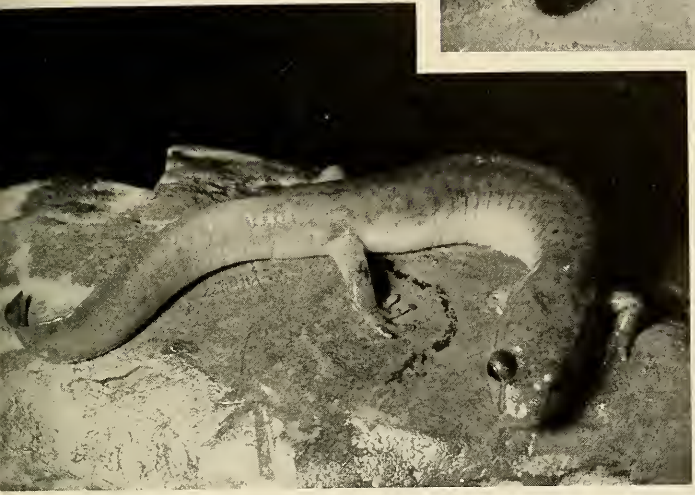
A home on dry land might seem to be most uncomfortable for a lungless salamander, but many of them live in such situations. Landlubbers, such as the slimy salamander, *Plethodon glutinosus*, and the red-backed salamander, *Plethodon cinereus*, surely possess a special mechanism for resisting desiccation. Such species usually do not go near water. They lay their eggs in little cavities in logs or humus, and the parents often brood them. Possibly the female remains with the young after they hatch, not to protect them from enemies but to prevent them from drying by keeping her moist body in contact with theirs. Salamanders, by and large, are not better endowed than some fishes in their ability to learn or remember, and few of the behavior patterns found in higher animals can be ascribed to them.

As in all animal groups, certain "personalities" stand out more than others. The purple salamander, *Gyrinophilus porphyriticus*, might be called Public Enemy No. 1 of the plethodontid world, because it is



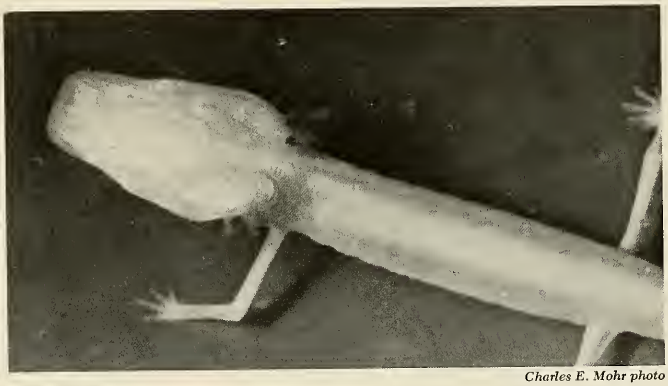
August Selckmann photo

➤ **The Slimy Salamander,** *Plethodon glutinosus,* is noted for its use of a sticky milk-white slime to escape from its enemies. The substance is not poisonous to man, but it leaves a mucous deposit on one's hands that is difficult to remove when it dries



August Selckmann photo

◀ **Despite its name,** the Purple Salamander (*Gyrinophilus porphyriticus*), is a salmon-colored creature. It is the cannibal of the salamander world, since it eats closely related salamanders and even its brothers and sisters. Its mating season is in the autumn, contrary to the schedule of most other wild animals



Charles E. Mohr photo

▼ **The Texas Blind Salamander** (*Pyphlomolge rathbuni*) never "grows up." That is, it never outgrows its larval habit of breathing through external gills. It is a rare inhabitant of underground streams in the Edwards Plateau, Texas. It has pin-point eyes beneath the skin

a confirmed cannibal. It is a suave, salmon-colored fellow that lives in very cold springs. It has been known to devour such close cousins as the four-toed, two-lined, and dusky salamanders, and it may even eat unlucky brothers and sisters. It also feeds upon aquatic insects, crustaceans, and even frogs—yet its total length is only six and a half inches.

It is in the autumn that the young male purple salamander's fancy lightly turns to young females. After an elaborate courtship involving a wrestling dance, eggs are laid in flat masses beneath stones in flowing water. Perhaps the eggs are brooded, but this is not definitely known.

The slimy salamander's chief claim to fame is its ability to exude a viscous, milk-white slime when it is seized by an enemy. It is a shiny creature, looking much like a licorice stick sprinkled with sugar. Its slime is harmless to man, but it is not soluble in water and is difficult to wash off when it dries. Perhaps it affords protection from other animals but not usually from a determined person.

Houdini never left an arm or leg behind after one of his spectacular escapades, but the slimy salamander will frequently part with an entire tail in order to remain free. If you grasp the creature by the tail, it will voluntarily twist it off. But you need not feel sorry, for the salamander will grow another in its place. A slimy's tail is used as a brace against a rock or burrow in the event of an attack.

If prizes were given for speed in disarticulating the body from the tail, the four-toed salamander, *Hemidactylium scutatum,* would easily take first place, because it has a curious constriction at the base of its tail. Four toes on each foot, rather than four on the front and five on the hind feet, set this salamander apart from other members of the family. The courtship proceedings in autumn consists of a series of what we might call "osculating" antics, during which the male applies his lips, cheeks, or the side of his body to the snout of the female. Courtship culminates when the female follows the male, keeping her chin closely pressed against the base of his tail. The male, especially when he is not moving forward, undulates the base of his tail from side to side. He deposits a sperm capsule, which is taken up by the cloacal lips of the female, and the eggs are subsequently fertilized. In spring the female retires to a nest or cavity in sphagnum moss at the water's edge. She occupies these little openings in the moss and rests *upside down,* grasping rootlets and bits of moss with her feet while slowly forcing the eggs out, one at a time. The process has been described by Dr. Sherman C. Bishop, America's famed salamander specialist. Laying eggs upside down is a common procedure among a large number of plethodontids. In fact, anyone who studies them carefully will note many curious modes of reproduction, feeding, and other habits.

The strangest plethodontid is a ghostlike creature dwelling in the caves and underground passages of the limestone region in the Ozarks of Missouri. This blind salamander, *Typhlotriton spelaeus,* has functional eyes as a larva, during which time it lives chiefly near the mouths of caves. But during metamorphosis it penetrates deeply into caves, and soon the lids draw together, fuse in part, and the light-sensitive rods and cones of the retina disappear. Scientists have found, however, that if the young metamorphosed blind salamander is subjected to the stimulus of light, it will develop functional eyes. Two other grotesque-looking blind salamanders are known, one from Texas, the other from Georgia, and they live in the netherland of wells and subterranean streams.

The lungless salamanders must really be considered more American than the American Indian, in the sense that the salamanders arrived first. Only one major family, the Salamandridae, is supposed to have existed when a connection between Europe and America was available in the early Eocene, 50 or 60 million years ago. When the continents separated, the American Salamandridae took to the mountain brooks of the Appalachians and took on plethodontid characteristics. The plethodontids are a much younger group, therefore—speaking in terms of millions of years—than some of the other families. They later became terrestrial and migrated to western North America and South America—all in a period of several million years. Even today the southern Appalachians have the largest concentration of lungless salamanders.

There is one puzzling species, the Mount Lyell salamander—a salamander with a European cousin. This salamander, *Hydromantes platycephalus,* made its debut into the scientific world by wandering into a mousetrap at an elevation of 10,800 feet in the Yosemite National Park. Since then, this Alpine salamander has attracted a great deal of attention because we find it so far removed from its nearest relative. A single related species is found in Sardinia, the French Alps, and part of northern Italy. How the two species can have become so widely separated, with the Atlantic Ocean in between, has been hard to explain. Dr. Emmett Reid Dunn, the brilliant student of lungless salamanders, has considered the *Hydromantes* a relict genus. He reasons that the genus must have traveled from America to Europe by way of Greenland and Iceland, since no more southerly route is known to have existed during the period under consideration. Another possible explanation is that these salamanders crossed from North America to Asia by means of the Bering Strait connection, which is known to have existed much more recently than any

Continued on page 332

Early "

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IN the fall of 1924, a workman, Mr. M. de Bruyn, blasting out rock in a limestone quarry about six miles from the little village of Taungs in South Africa, discovered a remarkable skull. He took it to be a fossil Bushman skull and showed it to Mr. Spiers, the manager. Mr. Spiers sent it to Prof. Raymond A. Dart, of the Witwatersrand University.

This Taungs Skull, as it came to be called, was one of the finest fossil human or prehuman skulls ever discovered. It was uncrushed and was beautifully preserved on one side. All the deciduous teeth and the permanent first molars, upper and lower, were in place, and their crowns were little worn. The lower jaw was actually in place, with only the rear lower part missing. Furthermore, the skull showed on one side most of the cast of the brain.

Within a few weeks, Dr. Dart had written his preliminary report on this find, in which he made the exciting statement that this skull was from "an extinct race of apes intermediate between anthropoids and man." He had secured the nearest thing to the popular conception of a "missing link." "Unlike *Pithecanthropus,*" he stated, "it does not represent an ape-like man, a caricature of precocious hominid failure, but a creature well advanced beyond modern anthropoids in just those characters . . . which are to be anticipated in an extinct link between man and his simian ancestor."

As soon as the discovery had been announced, Dr. Robert Broom went to Johannesburg to see it. Dr. Broom, then in his fifty-eighth year,

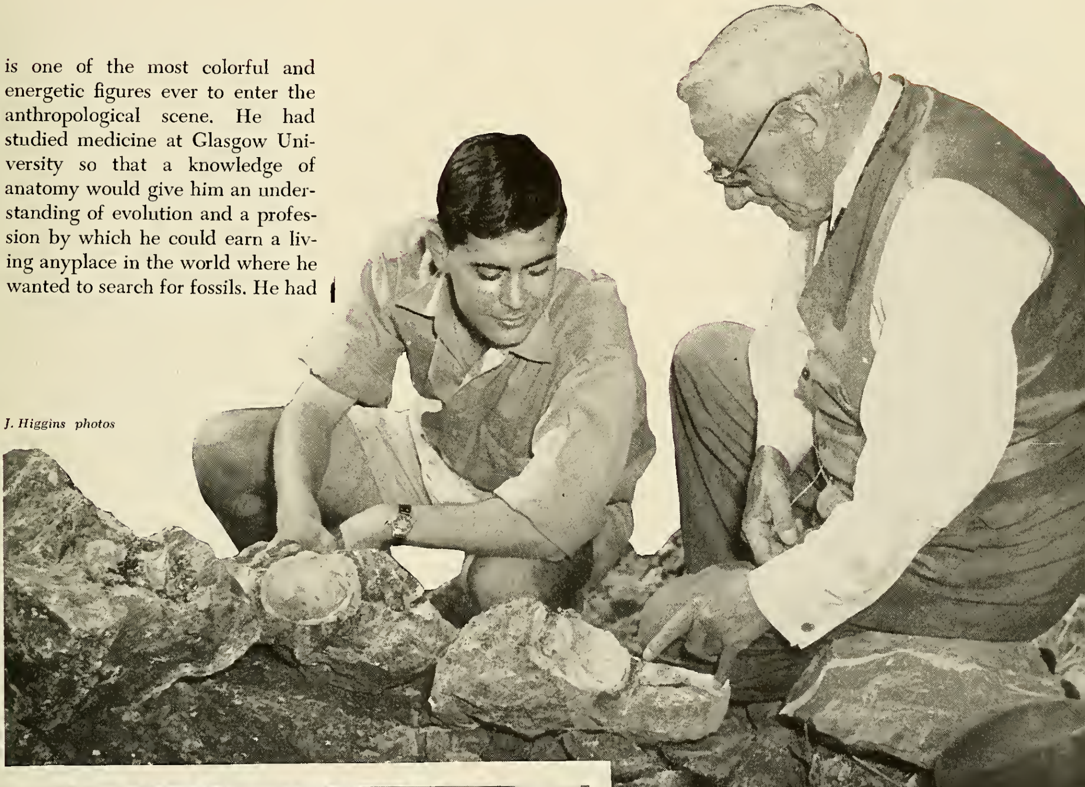
ssing Links" from Africa

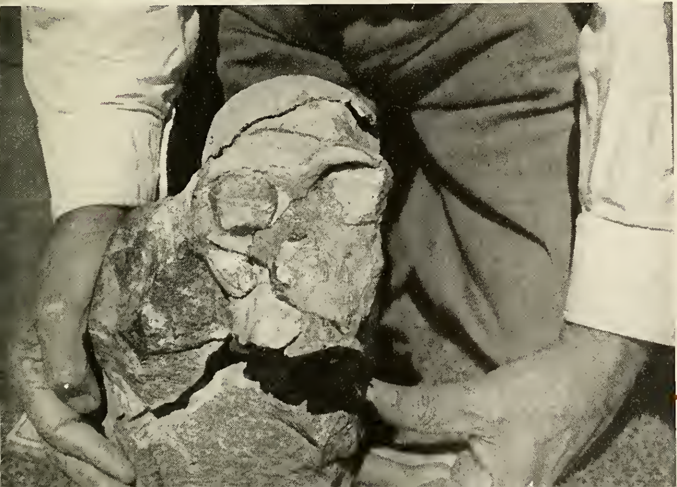
amatic discoveries clarifying man's earliest ancestry have come from the Transvaal

By DAN LINCOLN THRAPP

is one of the most colorful and energetic figures ever to enter the anthropological scene. He had studied medicine at Glasgow University so that a knowledge of anatomy would give him an understanding of evolution and a profession by which he could earn a living anyplace in the world where he wanted to search for fossils. He had

J. Higgins photos





▲ THE STERKFONTEIN SKULL found by Dr. Robert Broom in April, 1947, was nearly perfect. The skull was broken across the brain cavity and was lined with a layer of lime crystals

◄ THE FACE. Here most of the stone has been removed and the pieces of the face have been temporarily put together to show the facial contours of the Sterkfontein Skull carried through his plan, and a quarter of a century of determination, diligence, and deduction, with the help of a little dynamite, had brought him wide recognition in the science of paleontology.

Dr. Broom stoutly supported Dr. Dart's conclusions as to the profound significance of this skull. It represented, he was convinced, a creature far from an ape and very close to the main stem of the human family tree.

Even though this skull conformed perfectly to the expectations of Darwin, Huxley, Haeckel, and their numerous successors, some scientists were slow to accept Dart's conclusions. The eminent physical anthropologist Aleš Hrdlička was on the fence. However, Dart's and Broom's conclusions were sooner or later welcomed by Prof. G. Elliot Smith and Prof. W. J. Sollas of Oxford, and by Drs. James H. McGregor and William K. Gregory of Columbia University and the American Museum.

Shortly after the discovery was announced, four of the leading anthropologists of Britain were asked by the British scientific publication *Nature* to express their views. They were Sir Arthur Keith, Prof. G. Elliot Smith, Sir Arthur Smith Woodward, and Dr. W. L. H. Duckworth, all world renowned.

Australopithecus africanus, as Dr. Dart named the skull, portrayed to Keith a blend of immature chimpanzee and gorilla characteristics, but he added, "Even if it be admitted that *Australopithecus* is an anthropoid ape, it is a very remarkable one. It is a true long-headed anthropoid—the first so far known."

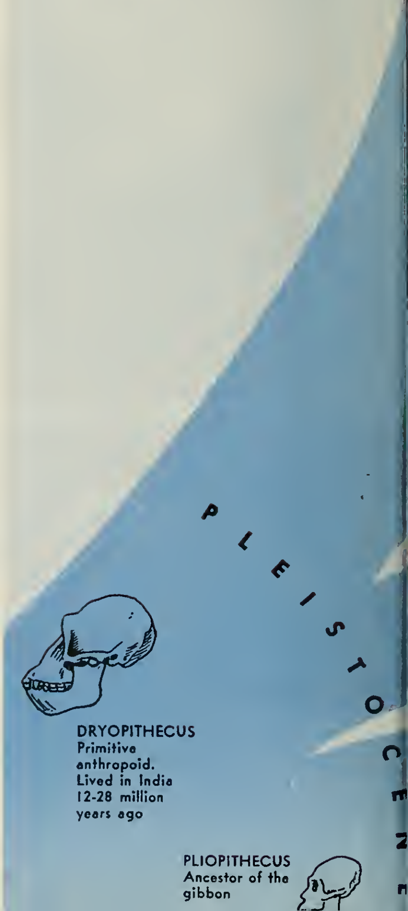
Elliot Smith thought Dart was "justified in creating a new species or even a new genus for his interesting fossil," but he thought that "many of the features cited by Prof. Dart as evidence of human affinities . . . are not unknown in the young of the giant anthropoids." Smith Woodward said, "So far as can be judged from the photograph I see nothing . . . definitely nearer to the human condition than the corresponding parts of the skull of a modern young chimpanzee." Duckworth admitted that the specimen "possesses exceptional interest and importance." He thought that some of the supposed manlike characteristics were due to "the youthfulness of the specimen," but added that "if the good points can be justified, then these characters of youth will not gravely affect the final decision." On the basis of evidence then at hand, these statements do not even now sound unreasonable for the most part.

But Drs. Broom and Dart set about together to change the views of the faraway scientific authorities whose word, they felt, might have a crucial effect on world-wide opinion. Dr. Broom sent a section of the Taungs skull to Oxford's Prof. W. J. Sollas, who was on record as agreeing with Elliot Smith. Sollas immediately replied that the section "seems to me to throw quite another light on the matter." He said he had just written to *Nature* to show how widely Taungs differed from a chimpanzee skull. And he was preparing another paper to show how nearly it resembled man.

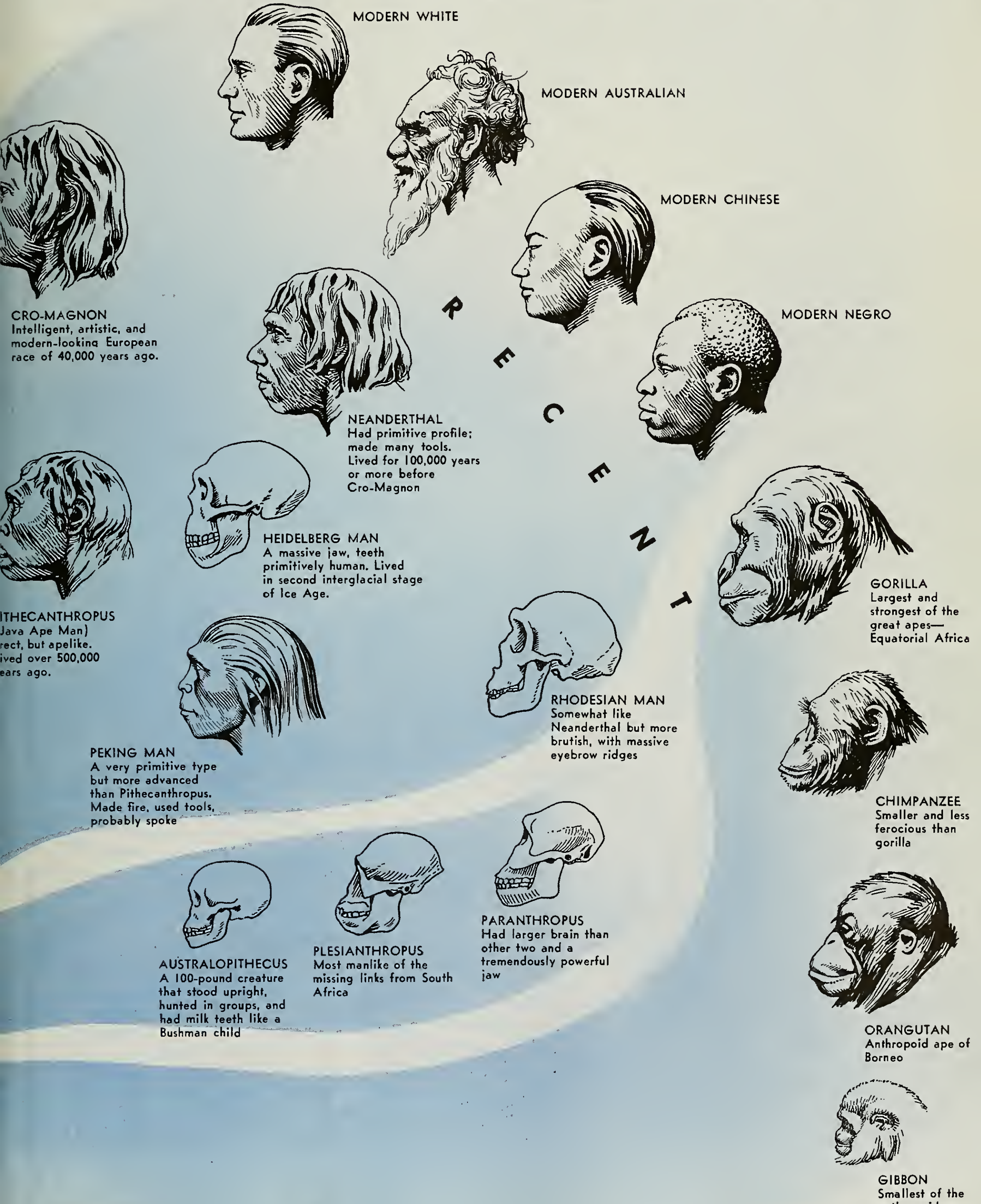
Elliot Smith soon came to agree with Sollas. American anthropologist Dr. Aleš Hrdlička agreed that *Australopithecus* was a "missing link" but qualified this by saying that it was one of many still "missing links in the realm of primate ancestry." Later, Dr. W. K. Gregory of the American Museum studied the teeth and found 20 characteristics in which they resembled or were transitional to man, none in which they clearly resembled the chimpanzee, and only three in which they were nearer to the gorilla or to the gorilla and chimpanzee. Other anthropologists gradually became convinced, and after the Sterkfontein and Kromdraai finds, which will be discussed later, even Sir Arthur Keith conceded, in 1944, that "no doubt they are much more human than I had originally supposed." Oxford University's famed anatomist Prof. W. E. Le Gros Clark has quite recently swung his full weight behind Dr. Broom in the conviction that the Australopithecinae, the sub-family of extinct forms defined by William K.

Among all living animals, the anthropoid apes, especially the gorilla and chimpanzee, come the nearest to man. The similarity is seen not only in their bones and internal organs but in the mode of reproduction and in the course of development within the body. The anthropoid apes are also the only animals that show the beginnings of human intelligence.

The three "missing links" from South Africa (*Australopithecus, Plesianthropus*, and *Paranthropus)* were much more like human beings than the modern apes in certain respects. On this chart, prepared from an exhibit in The American Museum, they fork off from the main stem and are not ancestral to any existing creatures. In this sense they might be called man's great uncles. Drs. Broom and Dart, on the other hand, have argued that these three "missing links" belong on the main evolutionary line and are our distant grandparents.



FAMILY TREE OF MAN



MODERN WHITE

MODERN AUSTRALIAN

MODERN CHINESE

MODERN NEGRO

CRO-MAGNON
Intelligent, artistic, and modern-looking European race of 40,000 years ago.

NEANDERTHAL
Had primitive profile; made many tools. Lived for 100,000 years or more before Cro-Magnon

HEIDELBERG MAN
A massive jaw, teeth primitively human. Lived in second interglacial stage of Ice Age.

ITHECANTHROPUS
Java Ape Man)
rect, but apelike.
ived over 500,000
ears ago.

PEKING MAN
A very primitive type but more advanced than Pithecanthropus. Made fire, used tools, probably spoke

RHODESIAN MAN
Somewhat like Neanderthal but more brutish, with massive eyebrow ridges

GORILLA
Largest and strongest of the great apes—Equatorial Africa

CHIMPANZEE
Smaller and less ferocious than gorilla

AUSTRALOPITHECUS
A 100-pound creature that stood upright, hunted in groups, and had milk teeth like a Bushman child

PLESIANTHROPUS
Most manlike of the missing links from South Africa

PARANTHROPUS
Had larger brain than other two and a tremendously powerful jaw

ORANGUTAN
Anthropoid ape of Borneo

GIBBON
Smallest of the anthropoid apes

Gregory and Milo Hellman in 1938, were very close to the main stream of human evolution.

The discovery of the Taungs Skull caused Dr. Broom to redouble his diligence as a fossil hunter, and he worked tirelessly to find additional evidence to support and amplify the original claims. But it was not until twelve years later that his devotion was rewarded. On August 17, 1936, at Sterkfontein, near Krügersdorp, a lime quarry foreman, G. W. Barlow, handed him the blasted-out natural brain cast of a missing link and asked, "Is this what you're after?" Dr. Broom replied, "That's what I'm after."

He at once began a meticulous search of the cave from which the brain cast had come. The next day he found additional pieces of the same specimen, and in a few years he had discovered parts of three other skulls, all probably of the same species. This type was different from the Taungs creature but evidently related to it. Dr. Broom continued his search for new types, and within two years he made another sensational find.

Barlow one day handed him a piece of a palate that he had gotten from a fifteen-year-old schoolboy, Gert Terblanche. The boy had found it at Kromdraai, two miles east of Sterkfontein.

"Of course I immediately set out in pursuit of Gert," wrote Dr. Broom. "I went to his home. Gert was in school, another two miles away; but I saw his mother and sister, and his sister took me up to the top of an adjacent hill where the specimen had been broken out of a weathered outcrop of bone breccia. The sister told me that Gert had four beautiful teeth with him at school, and she was sure he had some other nice pieces hidden away somewhere.

"I went off to the school. It was playtime, about 12:30 P.M., when I arrived. I saw the principal and told him what I had come about. Gert was found, and he drew from his trousers pocket four of the most wonderful teeth ever seen in the world's history. Two of these fitted on the palate that I had in my pocket. The other two were teeth of the other side.

"Gert told me that there were some more bits hidden away on the hillside. As the school broke up at 2 o'clock, I suggested to the principal that I would give a lecture to the teachers and the children on how the caves were formed and how animal bones got into them. He was delighted. So I lectured to 4 teachers and about 120 children for over an hour. As it was now almost 2 o'clock, the principal dismissed the classes, and Gert came away with me and took me to the place on the hill where he had carefully hidden away a nice lower jaw. I gathered every fragment." The newest find was different from either the Sterkfontein or the Taungs remains.

Dr. Broom now had three distinct types of apemen, or man-apes —the argument over which they are to be called has not yet ended.

Each of the three new finds, Dr. Broom believed, represented a different genus. The Taungs skull had been named *Australopithecus africanus* Dart. The Sterkfontein creature became *Plesianthropus transvaalensis* (Broom). And the Kromdraai specimen, which had been found by Gert Terblanche, was named *Paranthropus robustus*

J. J. Wesselo photo. Copyright.

◂ DR. BROOM comparing the Sterkfontein brain case with the human (*left*) and the chimpanzee (*right*). Though it is much smaller, he considers it more closely related to the human

Broom, the "*robustus*" referring to its tremendously powerful jaw.

Dr. Broom resumed digging at Sterkfontein after the war and within a few months found parts of several other skulls. He also found the greater part of a pelvis that was almost human and many limb bones of his strange and important little creatures. In all, he probably has pieces from a dozen or more different individuals, and some of the skulls are nearly complete and quite uncrushed. From them, and from the ribs and limb bones, he could tell quite a bit about what sort of animals they represented. Of the three, *Plesianthropus* seemed the most manlike, although *Paranthropus* had the largest brain. His *Paranthropus crassidens* jaw, found quite recently in a new site (Swart Krans) has an incipient chin, and its general appearance is "almost human." Thus, some of the later Australopithecinae may have crossed the invisible and arbitrary border between apes and men.

The face bones of *Plesianthropus*, in certain details approach the human, and the limb bones were so manlike that at first there was some suspicion that modern bones might have been intermixed with the fossils. This was promptly proved impossible. Entire limb bones are as yet extremely rare, but Prof. Straus of Johns Hopkins has made prolonged studies of the distal end of the humerus ascribed to *Paranthropus robustus* and has stated that it falls within the ranges of both apes and men. Therefore, its exact status is indeterminate. Prof. Straus has recently examined the distal end of a thighbone and states that it is "wholly unlike the great apes." On the other hand, Dr. Broom has shown that the talus (anklebone) is close to the Bushman's, though the rounded bearing surface on the lower end is wider.

Most outstanding to a scientist were the teeth, but here again the question can be raised, "Where do apes stop and men begin?" The boundary line is, of course, arbitrarily set by man, not by nature. The canine tooth was not long and fanglike, as it is in modern anthropoids, especially in the males. The teeth were arranged in a palatal arch almost like that in a human skull, and from the wear on the grinding surfaces it was clear that their owners had chewed like human beings. The milk teeth of *Australopithecus* were almost identical with the milk teeth of a Bushman child, Dr. Broom found, and in some important characters very different from those of apes.

Also, the milk teeth referred by him to *Paranthropus robustus* were amazingly similar to a Bushman's. Could they by any chance *be* those of ancient Bushmen? Here the geologists Charles L. Camp and George B. Barbour agree with Dr. Broom that no modern Bushman could possibly have become fossilized in association with Broom's specimens.

Even a cursory examination showed that these fossils, like the Taungs Skull, were going to be of more than ordinary interest to science. In 1929, Dr. Dart had written of the original discovery: "The geographical position of the Taungs deposit showed for this anthropoid an environment which up to that time had been regarded as impossible for an ape. We never knew before of an ape which lived on a cliff or plateau overlooking broad, forestless plains, on the fringe of a desert . . . Geography showed us that it was an impossible kind of ape – a terrestrial, fleet-footed, or cursorial ape. It was an animal-hunting, flesh-eating, skull-cracking and bone-breaking ape. It was a cave dweller. It was the most generalized of all apes."

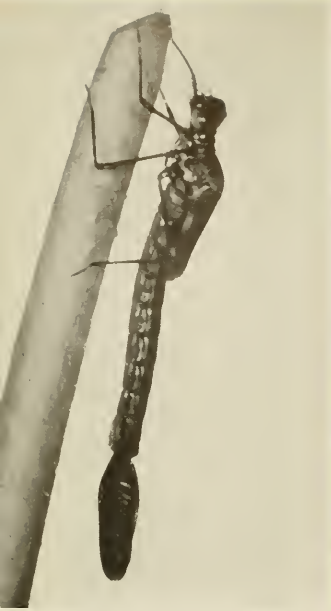
These creatures stood upright like man, but they only weighed 100 pounds or so. Their brains, though very small by human standards, were much larger in proportion to their bodies than in any modern ape. In fact, the ratio of brain to body approached that of man. They lived in groups, hunted in packs, crushed the skulls of captured baboons with the leg bones of antelopes, and may have had some sort of speech.

The question of how long ago these animals lived has evoked much lively debate. Ordinarily, beds of rock can best be dated by the species of animals found in association with them. But in South Africa, the fossil animals found in association with *Plesianthropus* and *Paranthropus* are local types that have no close relatives among the animals of Europe and Asia, where the standard geologic column has been worked out.

The animal remains are fairly abundant, however, and future researches will help greatly to clear up this question. Most of the animals were desert or open-plains types. With *Plesianthropus* were found a saber-toothed tiger, golden moles, two types of baboons, antelopes, and hyenas, and in a near-by cave were found some horse teeth. With the Taungs specimen were found small extinct baboons, their skulls crushed neatly as though with particular antelope leg bones, which, in fact, sometimes fit the dents. Other creatures from the Taungs caves include a hyrax, a mole, a shrew, two types of antelopes, a rock rat, and several ordinary rats. Gert Terblanche's *Paranthropus* skull from Kromdraai presented greater difficulties, because it was weathered out from an outcropping that showed few other bones, although there was some fine breccia not far distant that may have been contemporaneous. In it are horses, baboons, saber-toothed cats, pigs, foxes, hyenas, and jackals.

The animals found in the three deposits would seem to belong in the Lower Pleistocene period, which began about a million years ago, or in the Upper Pliocene, which preceded it. Dr. Broom thinks that all may be safely assumed to be over 750,000 years old and that many may be well over 1,000,000 years old—probably 1,500,000 years, perhaps even more. Thus he believes that a few belong in the Lower Pleistocene but that most are from the Upper Pliocene. Support for this latter theory might appear to lie in a special type of hyena known only from the Pliocene and found in the Sterkfontein caves

Continued on page 333



WHEN ITS TIME IS RIPE, the bulbous-
ed nymph climbs a plant stem to a
sition a little above the water surface.
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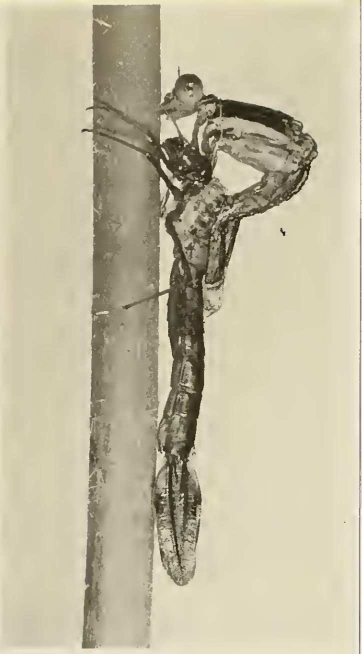
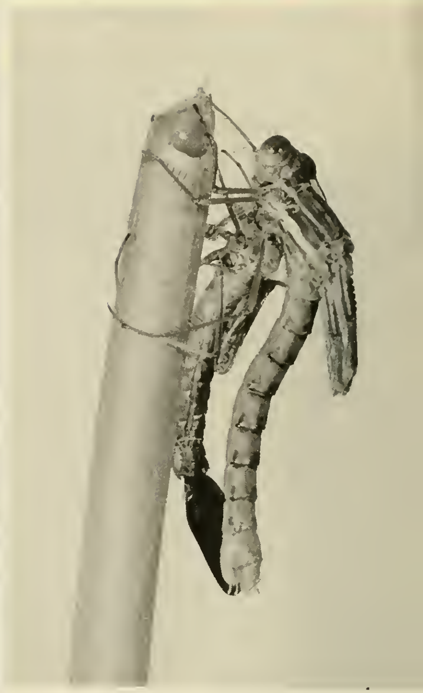
h but are, in reality, the water-breath-
g gills



▲ ANCHORING the tarsal claws securely, a slow pumping action soon produces a dorsal rupture just forward of the wing pads, and a hump of the new animal appears



▲ THE FOLDED AND CRUMPLED WINGS are soon seen, prophetic of the creature's coming mastery of the air

Debut of a Damsel Fly

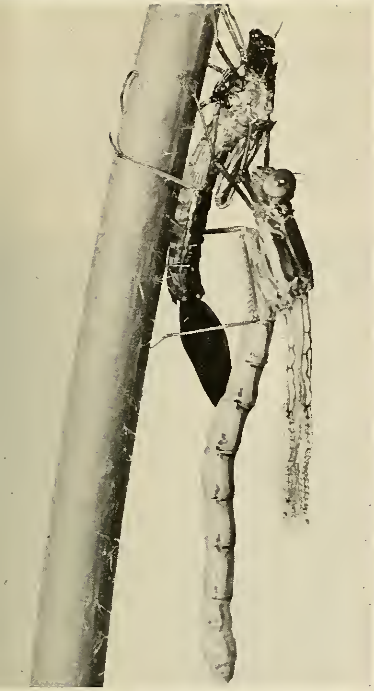
A fairy of the upper air, which "down the listed sunbeam rides resplendent"

By WALKER VAN RIPER
Denver Museum of Natural History

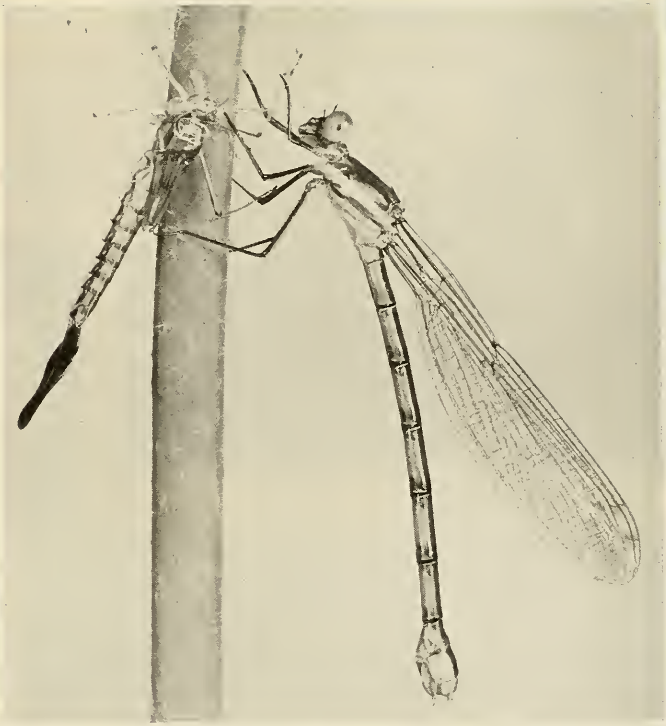
All photographs by the author

THE spectacle of the transformation from nymph to damsel fly is common enough in nature, yet it is not often seen. The voracious nymph lives in stagnant ponds and has curious forward-shooting, grappling tongs with which to capture its prey. This unattractive creature becomes a beautiful, mosquito-eating damsel fly of the upper air. It completely changes its form and mode of life during the period of an hour or more. This is a time of great risk and danger, for the insect is entirely helpless, incapable of flight or other movement and an easy prey to its chief enemies—birds and frogs. For the most part, the risk is avoidable if the insect undergoes its transformation before the break of day, and such has become its general habit. This is the reason, of course, why the process is rarely observed.

The accompanying pictures were taken with a high-speed electric flash, the exposures being about 1/5000 of a second at aperture f.32. The subject is a stalk-winged damsel fly of the family Coenagrionidae.

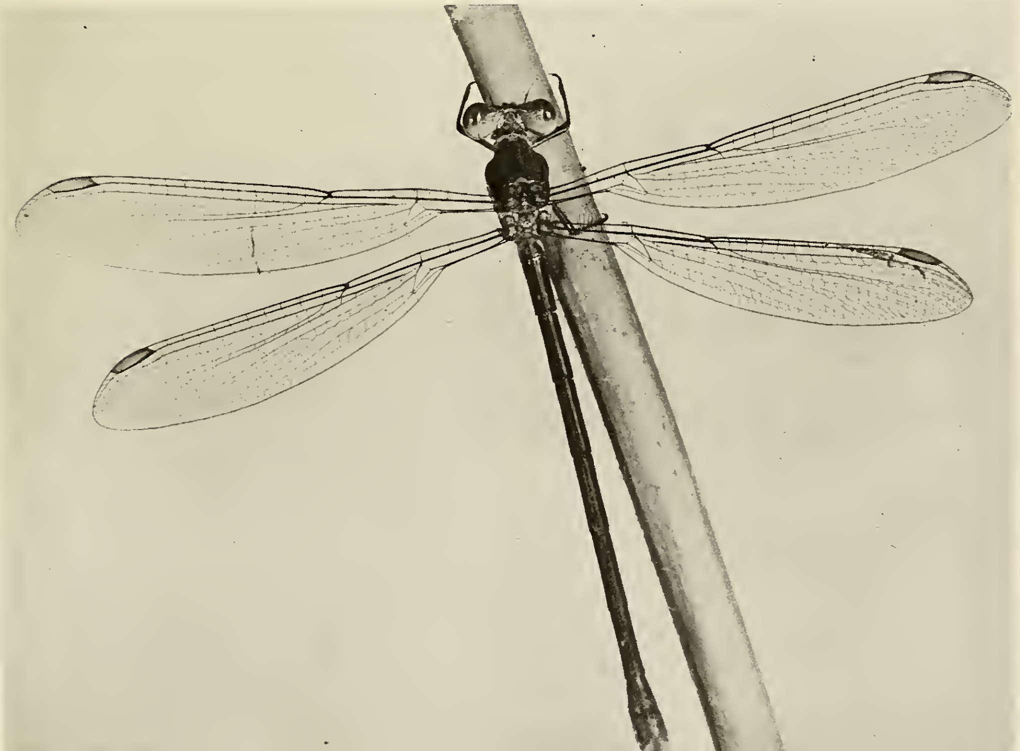


▲ SLOWLY THE WINGS unfold, and the abdomen lengthens considerably



▲ THE WINGS FLUTTER, delicate and gauzelike . . .

▼ . . . AND OUT of its ugly shroud, a diaphanous new damsel fly is ready to become air-borne



▲ A **Basuto elder** looks out over his country

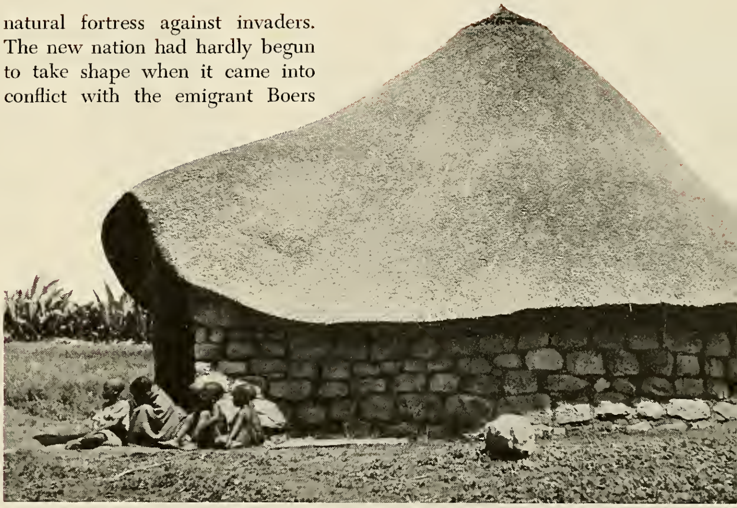
▼ A **Basuto herd boy**: a common Basutoland scene. Schoolteachers have a hard time teaching these youngsters, for their attendance is erratic. A Basuto has little use for money in the bank and measures wealth in terms of cattle and sheep. This has led to soil erosion from serious overstocking. Most young men pay for their brides in cattle

Basutoland

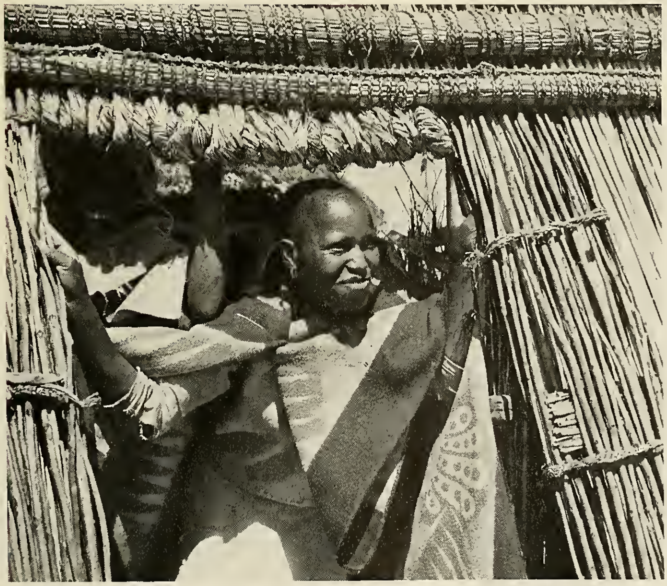
By Constance Stuart

Welded together almost a century and a half ago under the genius of their great leader Moshesh, the Basutos seek to retain their cultural identity and their right of self-determination under the awakening influence of modern education

FROM about 1820 onward, Moshesh, a young chieftain of insignificant stock, succeeded by his diplomatic skill in gathering together the remnants of tribes that had been scattered by the raids of the Zulus and the Matabele. He settled with them in the mountains of Basutoland, which formed a natural fortress against invaders. The new nation had hardly begun to take shape when it came into conflict with the emigrant Boers of the Great Trek, commonly called the Voortrekkers, the result being that the Basutos lost part of their territory. Moshesh thereupon appealed for and was granted British protection, under which a series of Paramount Chiefs have ruled ever since. The Basutos thrived as a nation and now have the largest population of the three protectorates that come under the British government's "indirect rule"—Basutoland, Swaziland, and Bechuanaland.



➤ A BASUTO HUT. Nowadays the walls are often made of stone, because there is very little timber



⮟ SOME OF THE HUTS have a fence of reeds around them for privacy. The reed curtain rolled up above this doorway can be lowered

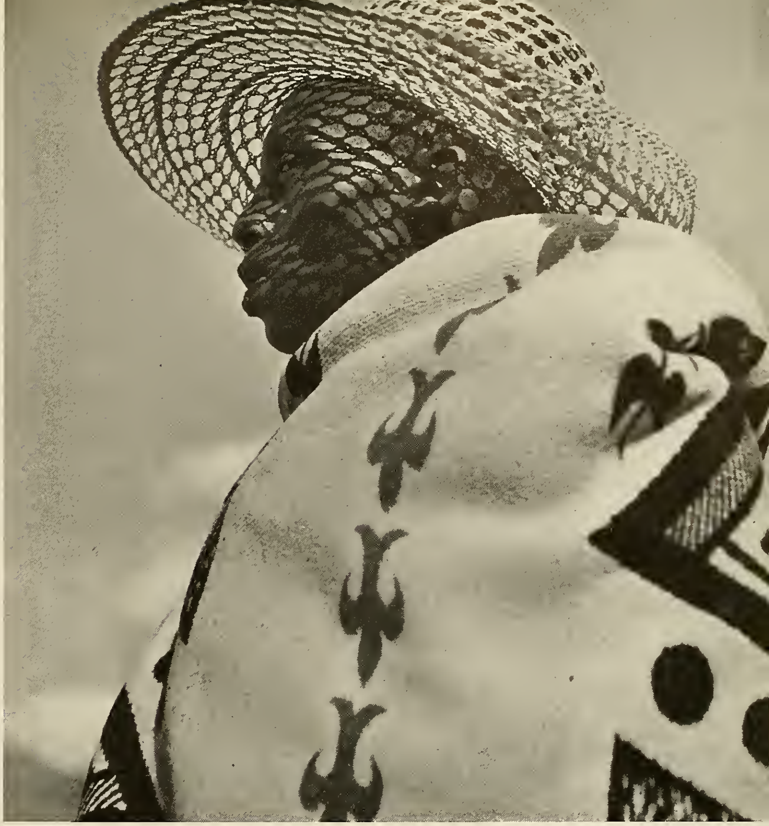
During World War II, 20,000 Basutos formed part of the African Pioneer Corps and served in the Mediterranean area. In 1947, the nation staged a great *Pitso* (meeting) of welcome for the Royal Family at Basutoland's capital,

➤ THIS HERD BOY wears his weather-beaten straw hat at a rakish angle. His young brother smiles shyly in the background like a little French gargoyle. Herd boys as young as five are not an uncommon sight

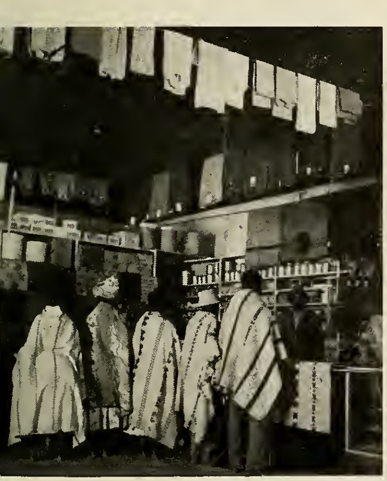
⮟ AT THE PARAMOUNT CHIEF'S KRAAL, or village. On the left is one of the "courts," where the head tribesmen meet daily to listen to cases of cattle theft, domestic troubles, etc.

Maseru. Thousands of Basutos rode for days from far up in the mountains and from the plains to be present at the greatest gathering of their people in many years. The small capital was filled with these colorful horsemen.

Basutoland has an area of 11,000 square miles—comparable to the state of Maryland—and a population of over 600,000. It is a native territory without European settlers or landowners and is governed by a system of "indirect rule." The Basutos swear their allegiance to a single Paramount Chief, under whom there are many lesser chiefs. Many of these chiefs



▲ SUMMER AND WINTER the Basuto wears his characteristic blanket of gay and varied design and color. Before the days of traders, skin clothing and (in cold weather) a simple undecorated cloak sufficed. Today the Basuto buys his blankets at European-run trading stores, which are scattered through the territory. The hat is woven of grass by the Basutos themselves



THE TRADING STORES are a center of contact with the outside world. lere the Basuto buys blankets, shirts, European hats to wear on undays, and yard goods. The more ambitious may even buy shoes, hich will hurt the native's feet, for he is unaccustomed to such con-nement. He can walk hundreds of miles in his bare feet

▼ THE MEN RETURN from the mines for six months at a stretch to enjoy the pleasures of family life and to look after their domestic concerns. Most Basutos own a little land where they grow corn and graze their stock

▼ BASUTOS COMING HOME from their stretch of work in the gold mines, 600 miles away in Johannesburg. The bus stops to allow them to buy potatoes and oranges from a roadside vendor

MAFETENG TO MAS
PHAMOLA
TAXI

▲ A BASUTO MOTHER AND CHILD

are related to the great Moshesh and are collectively known as his "sons."

The visitor finds this one of the most picturesque of native territories, with its ranges of mountains, its men clad in colorful blankets and riding Basuto ponies, and its well-built thatched villages, grouped at the foot of the mountains.

Education is considerably affected by the mountainous nature of the country. There is a tendency to concentrate the schools in the lowlands, which comprise only one-third of the country, to the detriment of the remaining two-thirds. In spite of this, a strong feeling for education exists among the Basutos, and this is doing much to combat the traditional witchcraft and superstition. But "ritual" murders and pagan initiation ceremonies are still practiced in villages less than a day's ride on horseback from the capital.

Basutoland subsists on its agriculture. In the lowlands, the main crops are maize and kaffir corn, which is grown during the Southern Hemisphere's summer. The heights above 8000 feet are termed "cattle post" areas and are used for

◂ Having a bath in the European fashion, rather than in the river

▴ After the bath is over

◂ Catholic influence from the mission stations scattered through Basutoland is evident in this Basuto's rosary. Best known of the missions has its own press, where many publications are printed in Se Suto, the language of the Basuto. Basuto witch doctors nevertheless have a powerful influence even over Christian members of the community. Many natives will not use European-trained doctors but prefer to take the witch doctor's brew, which probably contains much that is harmful, such as bits of decayed animals

▲ Basuto woman. Hair longer than this is seldom seen

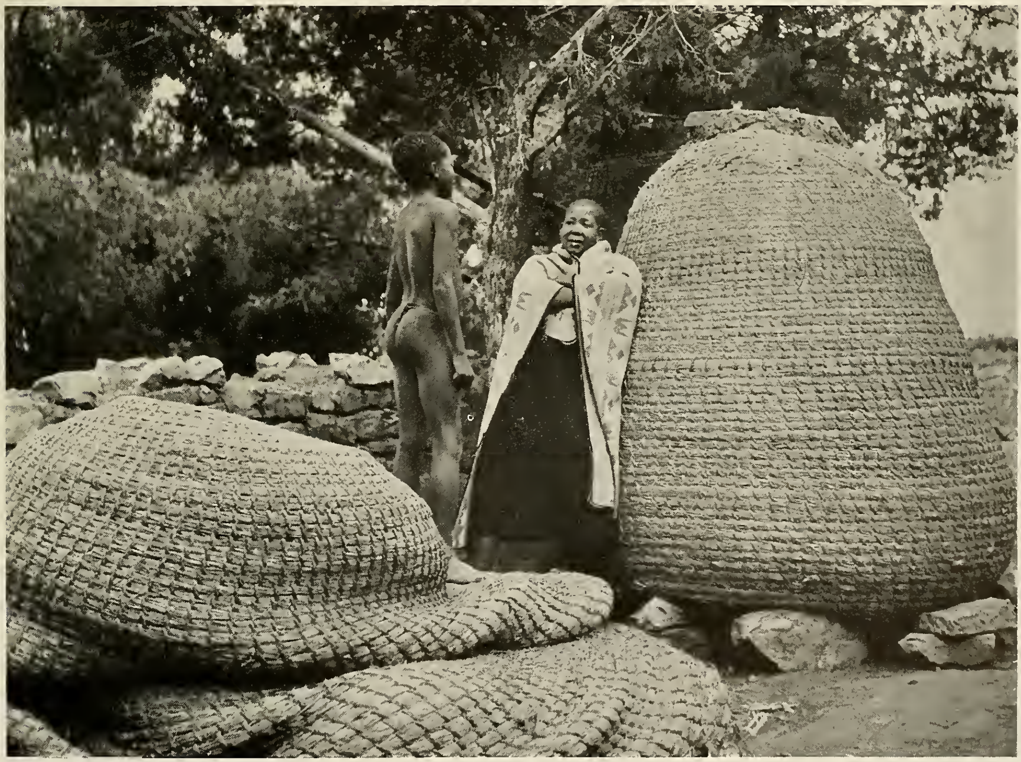
◄ Horseman of Basutoland. The "Basuto pony," a breed developed locally, is famous throughout South Africa for its hardiness and sure-footedness on mountain trails grazing, livestock being moved to them from the lowlands for the summer and back again for the winter months.

The chief exports to the Union of South Africa are wool, wheat, and cattle. The arable land is insufficient to maintain the population, and many thousands of Basutos are recruited yearly to the mines, to industrial centers, and to farms, from which they send back their contributions to the national wealth.

There are few roads on which cars can travel in Basutoland, but there is a network of bridle paths up into the mountains. Thus one can reach any village or any part of the country by horse or by sturdy Basuto pony. The only railway in the country is a track one mile long, which connects Maseru with the Union of South Africa.

▲ A LITTLE BASUTO GIRL, who even though young, displays the natural dignity of her people

▼ THE BASUTOS WEAVE these immense baskets to hold their corn in winter. Talking to the youngster is a daughter of the Paramount Chieftainess



A "Little Yellowstone" that operates—of all places—in the dry-as-dust Nevada desert

NEVADA'S
VALLEY OF GEYSERS

By NELL MURBARGER

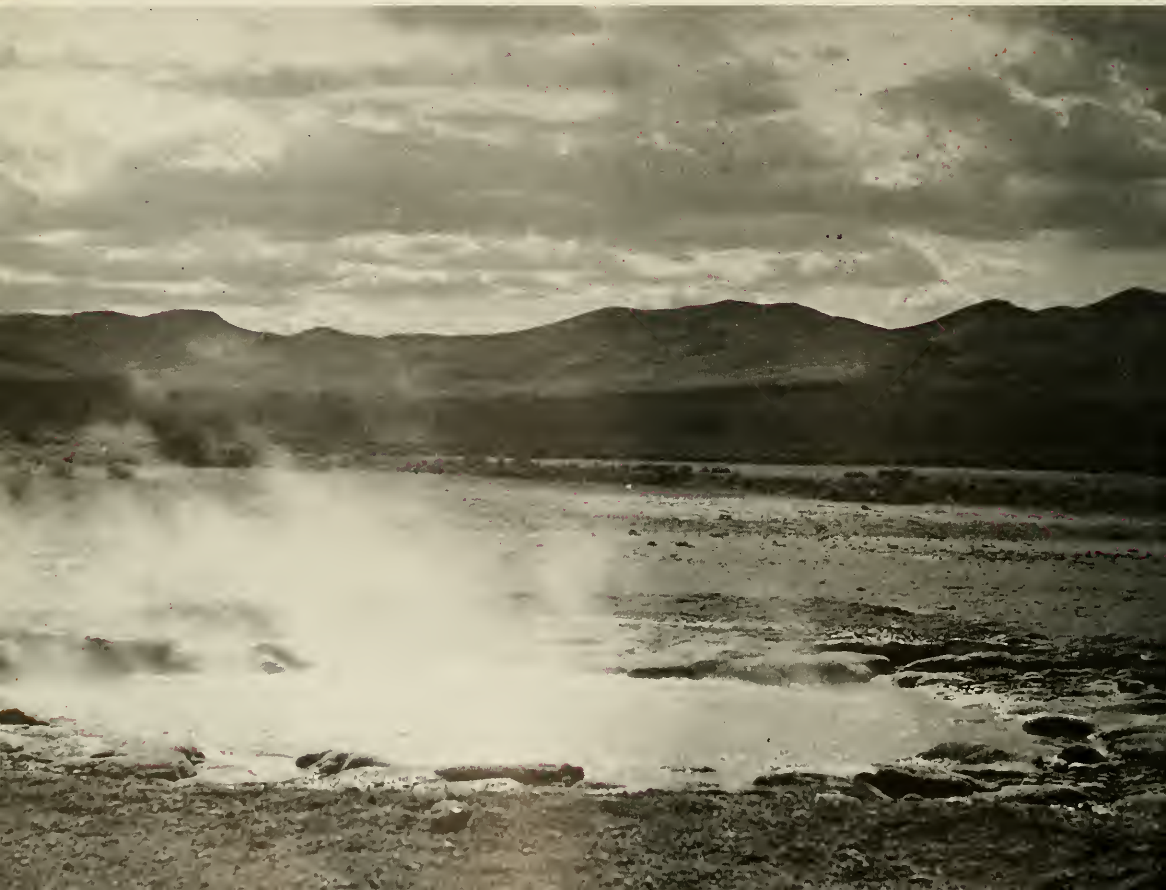
Photographs by the author

IT was an old Nevada miner who first told me of Whirlwind Valley. He described it as a place where scalding steam jetted from fissures in an opal terrace, where crystal pools pulsed with boiling water, where mud pots blubbered, and ominous rumblings issued from subterranean grottoes. This was fascinating campfire talk, and I put it down for just that. I had camped and explored in every county and mountain range in Nevada, and if such a place existed, it seemed impossible that I shouldn't have heard of it.

Several months later, B. F. Couch, Librarian of the Mackay School of Mines, at Reno, assured me that the miner's tale was more than idle talk, that there was such a field of thermal activity about seven miles southwest of Beowawe, in Eureka County. So little was it known, he said, that my ignorance of it was altogether understandable.

Originally discovered by white men about 1867, Whirlwind Valley had been first described in a feature article by Albert S. Evans, published in 1869 in the *Overland Monthly* of San Francisco. More than two generations seem to have

▼ DESERT CONTRADICTION: steam rising from a hot pool in the barren flats of Whirlwind Valley. This is the largest of the five springs in the valley floor



elapsed before a second report was issued—a technical treatise in the *American Journal of Science* for March, 1934. It was prepared by T. B. Nolan and G. B. Anderson of the United States Geological Survey following "a few hours" spent in the study of the area in August, 1932.

"So far as we can find, nothing further has been published on the district," Mr. Couch said.

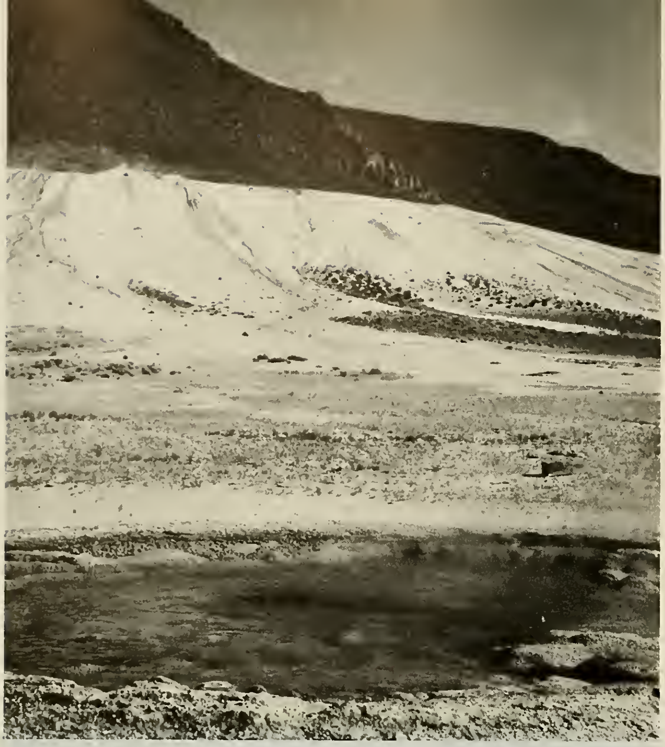
From the Nolan-Anderson, report, I gathered that the Whirlwind Valley geyser field was not exactly a second Yellowstone. Yet the idea of boiling water gushing from central Nevada's dry-as-dust desert ranges was, in itself, a prospect sufficiently alluring to draw me to the place at the first opportunity.

After provisioning in the small desert village of Beowawe, my companion—Dora Tucker—and I headed out across a broad, white alkaline flat. In giving us directions for finding the geysers, the storekeeper at Beowawe had said that for five miles our road would consist of nothing but the bosom of this flat and that in crossing it we must maintain a sharp watch to avoid wet areas.

▲ **Erupting** at irregular intervals, the largest geyser on the terrace shoots hot water and steam to a height of 25 or 30 feet

◀ **Several small geysers,** such as this one, erupt to a height of two or three feet

"Not that there's any actual water on the flat," he said, "but there's underground seepage. Occasionally you'll come to areas where the powdery white surface of the ground appears slightly darker. That means it's wet just beneath the crust—not only wet but practically bottomless! If you're careful to stay clear of these boggy areas, I think you can make it—un-



▲ THE COLOR-STREAKED SINTER TERRACE (*middleground*) is the area of greatest thermal activity. It includes low-spouting geysers, hot bubbling springs, blubbering mud pots, and subterranean caves

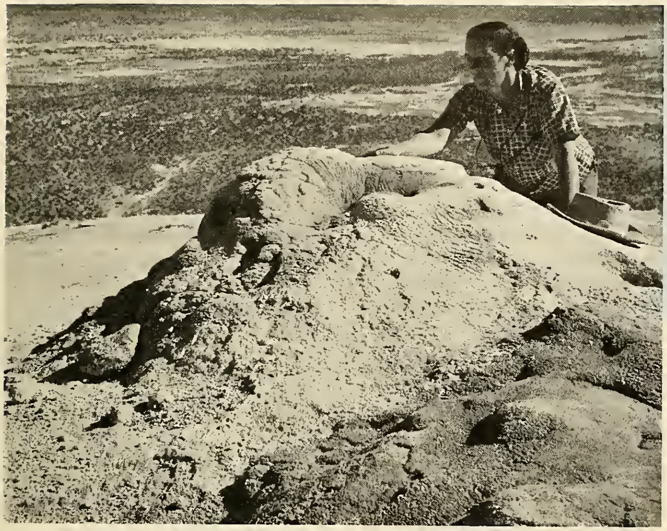
less you get caught in a rain!" Critically appraising a handful of clouds on the eastern horizon, the storekeeper glared sternly at us and wagged an authoritative forefinger. "Just remember!" he warned. "If it starts to sprinkle, *get out of there, quick!*"

For the first mile or so out of town our two wheel tracks clung precariously to the top of a low, narrow dike. Then we came to a sheep fence, and letting ourselves through the gate, we found the dike at an end. Beyond that point we had our choice of a dozen "trails" which wandered willy-nilly over a broad, white expanse, as desolate and barren as the bed of a dry borax lake. Rising abruptly to the right and left of the flat were rocky, brown mountain ranges, and ahead of us the South rim of the valley was lost in a misty blueness.

Mindful of advance warnings, I eased the car along half dubiously. We had driven about half a mile when the first of the treacherous "dark" spots suddenly appeared. I swung sharply aside and halted the

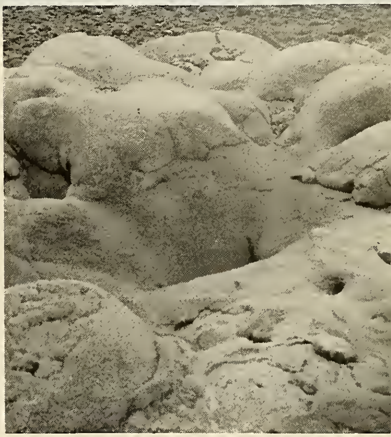
▲ THE LARGEST SPRING in the flat below the terrace occasionally displayed eruptive periods of unusual agitation and churning. At these times the water showed its highest range of temperature

▼ STEAM SPIRALS from the vents and hot-water pools at the lower end of the sinter terrace. The roarings and rumblings of the disturbed waters produce an unearthly effect



◄ THE AUTHOR inspecting one of the opaline collars that have formed about the larger geysers on the terrace

▼ MANY OF THE ACTIVE GEYSERS are surrounded by mounds such as this one, composed of opal fragments loosely joined together in a form resembling coral



car. Wheel tracks showed where other recent travelers had failed to spot the bog in time. Pulverized greasewood, mud-plastered burlap sacks, chicken wire, and splintered boards showed that a long and laborious struggle had been necessary to free the vehicle that had plunged into its hubs. From that point onward dark spots appeared with increasing frequency, but eternal vigilance and a five-mile-an-hour pace kept us free of trouble.

So intently had our eyes been riveted on the flat ahead that we were nearly to our destination before we first glimpsed the jetting steam and water. This was it! Mentally, I apologized to the old miner whose veracity I had doubted.

Soon we were close to the rocky hills bordering the flat on the east. We were traveling at the foot of a sinter terrace that stretched along the range for a distance of a half mile or more, its rim about 250 feet above the valley floor. Chiefly white, the terrace was streaked with shades of yellow, rose, and brown, and steam spiraled from it in a dozen or more places. Additional steam was rising from a group of hot-water pools situated on the flat near the base of the terrace.

► THE AUTHOR'S CAMP in the Valley of Geysers. Despite the presence of water, the entire flat is virtually barren of vegetation, presumably because of the chemical content of the springs on the soil

The largest of these lower springs was shaped like a twelve-foot morning-glory. A small opening ten feet below the surface connected it with the subterranean water supply. For a few minutes after our arrival, the pool lay so clear and quiet that grains of course sand were plainly visible on its floor.

Gradually, gas bubbles half as large as a man's head began rising from the submerged entrance, and the water started creeping up the sides of the rock basin. Within a few minutes the surface had risen a foot. It was pulsating and churning vigorously and beginning to overflow the pool. Gas bubbles were now escaping with such intensity that the water level in the central portion of the spring was six to eight inches higher than on the sides.

As excess water drained away, the pool gradually settled back to its normal level and in a short while again stood motionless, without ripple or quiver. Timing the operation, we found that the complete cycle of rising, overflowing, and subsiding was repeated every twenty minutes. During the period that the water stood quietly, its temperature registered around 162 degrees F., but at the apex of its eruption, the thermometer showed a temperature of 170 degrees—only about 33 degrees below the boiling point in this elevation of nearly 5000 feet.

Six feet away was a small spring where the water showed less movement and slightly lower temperature; and fifteen yards to the southwest lay a third spring in which the water likewise rose at twenty-minute intervals. Strangely, the low stage of this pool appeared to coincide with the high period of the largest spring.

Owing to the high alkalinity of the deposit, the entire flat was virtually barren of vegetation, but one of the near-boiling springs was completely enveloped in a jungle of salt grass—a jungle that swarmed with the largest and hungriest mosquitoes in all Nevada!

We found that water from the big spring, though not exactly pleasant, was far from unpalatable. A pint jarful collected here showed a mineral content of 1100-odd parts per million—a count that health experts frown upon but do not consider positively injurious. Were one contemplating actual use of the water, consideration would naturally have to be given to the type of minerals it contains. Water from the big spring contained 415 parts silica—an extremely high figure—but experimentation with a cake of toilet soap showed that it hadn't the slightest trace of hardness. There was no odor of sulphur, generally so prevalent in areas of thermal activity.

A dozen plumes of steam rising from vents in the big terrace directly above us tempted us to explore, but as the sun already was dipping low over the range to the west, we decided to make camp and wait till morning.

But there were a vast number of clouds in the sky, and they were entirely too red. They spelled rain. We had already seen enough of the alkali flat to realize what danger rain could bring, for once the top crust was uniformly moist, it would no longer be possible to detect the treacherous pockets beneath.

Several times in the night I awoke and peered hopefully from my sleeping bag, each time praying for the sight of stars shining in a clear sky. But each time I saw only fast-scudding clouds that covered and uncovered the moon. Periodic flashes of lightning revealed ghostly white spirals of steam still rising from the terrace, and an occasional low rumble of thunder threw over our camp a strange eerieness.

About dawn we were awakened by king-sized drops of rain splashing into our faces and spatting on the car and the canvas tarpaulins covering our beds. We lost no time getting into action.

As we hurried through our breakfast, my eyes shifted from the rain clouds to the terrace that beckoned so enchantingly.

Dora read my thoughts. "Why don't you go on up there?" she said. "I'll stay here and pack the car, and we can leave the minute you get back."

Although fully mindful of the old storekeeper's warning, I wanted so much to view the terrace that I grabbed my camera and tripod and headed up the steep, rocky slope at the best speed I could muster in the half light of 5 A.M.

Little vegetation grew on the mineral-impregnated slope except at one point where an overflow of iron-laden water from the geysers had cut a red sluiceway down the wall. Closely bordering the vile-looking stream was a luxuriant fringe of shooting stars, or wild cyclamens—the only ones we noted anywhere in the vicinity.

It was a difficult climb, at times very steep. The overflow of water had saturated large areas of the soil, leaving it slick as grease. Reaching my destination, I pulled myself over the sharp lip of the terrace and looked out upon a rocky ledge, nearly 100 feet in width and a half mile long. An amazing color-streaked ledge, it was strewn with every variety of thermal activity, from low-spouting geysers and hot bubbling springs to blubbering mud pots and subterranean caves. The roarings and rumblings were unearthly—nearly as ominous as the thunder then rolling over the desert mountains to the east.

Although it was nearly sunrise, the sky was dark with heavy clouds, and the light was very weak and inadequate. I determined, however, to photograph as many of the springs and fumeroles as possible, and, at the same time to take a census of their number.

All the active geysers were surrounded by mounds of siliceous sinter, largely composed of opal fragments loosely cemented together in a form resembling coral. In some areas this opal showed a distinct blue-green cast, due, presumably, to the presence of algae. Other sections of the terrace presented a smooth surface of solid white opal, exhibiting occasional glints of rose or iridescence. Of the mounds surrounding vents, few were more than a foot in height, but one I noted had built up an opalescent collar at least three feet thick. Blocks of basalt, which had lodged on the terrace after rolling down the steep slope above, had also been covered with layers of the sinter.

While nothing about the mud pots appeared especially unusual, Nolan and Anderson tell us in their monograph that ten per cent of the mud consists of diatoms, which the U.S. Geological Survey has classified into ten species. Of these, three were noted as "rare," two as "frequent," and five as "common."

In my necessarily swift census, I counted 57 vents or boiling springs—many of them hot little pools not more than 12 to 18 inches in diameter. A considerable number of these showed gas bubbles and a small overflow but could not properly be said to erupt. Altogether, I feel certain that the area must embrace more than 100 live outlets, as well as a great many apparently inactive vents.

The sky was growing darker, a chill wind was coming in gusty blasts, and the puddle-sized raindrops were striking with increasing frequency. So I reluctantly left the strange scene and hustled down the steep face of the terrace to join my partner, who was waiting for me.

Since we could still see the wheel tracks we had made the previous afternoon, our crossing of the boggy flat was accomplished in short order. Reaching the safety of the dike, we halted momentarily to look back.

We could still discern the summits of the Cortez and Shoshone ranges, now raked by dark, rolling storm clouds. Between them, however, lay only an ominous blue-gray void. Whirlwind Valley, with its steam jets, mud pots, and strange sinter terrace, was completely lost to view in a black downpour.

the ROSEATE Spoonbill

It has gained ground in Texas and Louisiana but remains rare in Florida.

By Hugo H. Schroder

Photographs by the author

▲ THE SPOONBILL holds its neck straight in flight, unlike its heron and egret neighbors

YOUNG roseate spoonbills are not born with a silver spoon in their bill. In fact, in spite of their name, they emerge from the egg without any spoon! Only adults have the unique flat bill that has earned them their name. The bill of the chick more nearly resembles that of a duck, and some time must pass before the broadening becomes evident.

Though an adult spoonbill is not a handsome creature when viewed head-on, its plumage was a much-desired commodity in the days when traffic in bird feathers was unlimited. In Texas, Florida, and Louisiana, where the spoonbill was once numerous, settlers and plume hunters killed it ruthlessly. Its feathers are pink, with vivid carmine on the wings; and fans made of the wings brought an attractive price. Like egrets, the curse of beauty almost led to the complete extinction of the spoonbill before feather traffic was outlawed and protective legislation passed.

Today egrets are commonly seen over a wide area, but spoonbills are still quite localized in their nesting. They have made a welcome comeback in Texas and Louisiana, but in Florida there seems to have been no halt in their decline. A small number still nests in certain regions of Florida, and they are known to wander into other parts of the state during summer and early fall, but the sight of a "pink curlew," as they are locally known, is a red-letter event to most bird observers.

I had been in Florida nearly a decade before I discovered my first spoonbill. This was in Mosquito Lagoon, east of Titusville, and several years later I saw another wandering spoonbill there. They have been seen in this area by other observers from time to time.

But I had to go to Texas to see spoonbills nesting. There I saw considerable numbers on islands in Galveston Bay—islands under protection of the National Audubon Society. Several hundred pairs nested there, along with American egrets and various other herons.

What a beautiful array of spoonbills I found one day, strung out from a sand bar in the bay—some 60 of the pink adults, lined up in the shallow water—a wonderful sight! On one island there were numerous spoonbill nests in low shrubbery, all with either eggs or small young. One nest contained two eggs and two youngsters, one just emerging, so I had an exceptional opportunity to record how the infant's bill appears at birth.

The other island contained a larger spoonbill nesting concentration. These nests had to be viewed from a distance; but it was possible to observe and photograph the birds from a hide-out in the shrubbery. All the nests appeared to contain well-grown young. There were frequent squabbles between neighboring spoonbills and between the spoonbills and their egret neighbors.

Roseate spoonbills nest only in tropical and subtropical regions and breed from the Gulf southward to the pampas of Argentina. Low shrubs and trees are favored nesting sites, but they have been known to build their nests on the ground. Nest building begins soon after the birds pair off and is completed during the mating period. This is a busy time for the male, for it is his responsibility to guard the territory from enemies and to gather the

nest-building materials. He delivers twigs and sticks to the female, and she works them into the nest.

Spoonbills brood once a year, and on the average, two or three eggs are laid. The incubation period is about three and a half weeks, during which the male relieves the female at intervals on the nest.

Although the feeding of the young in the nest was always too distant for me to film successfully, I was able to observe the procedure. When the parent spoonbill returned to the nest with a supply of food, Junior would thrust his bill into the side of the parent's bill and partake of his dinner. When the young leave the nests, they learn to search for food in the shallow waters where the spoonbills regularly feed.

The feeding process is an unusual one. Moving about in the shoals, the spoonbill swings its bill from side to side until the prey is located. This motion seems to be instinctive, for Robert Porter Allen, in his thorough study, *The Roseate Spoonbill* (National Audubon Society, N. Y., 1942), points out that hungry spoonbills in captivity will "wag" their bills even when food is not available. The bird does not scoop up its prey but rather grips it, forceps-fashion, between the tips of the bill and then lifts and shakes its head, sending the food into the throat. The bill is equipped with sensitive nerve endings that are valuable "feelers" in muddy waters, where prey cannot be seen.

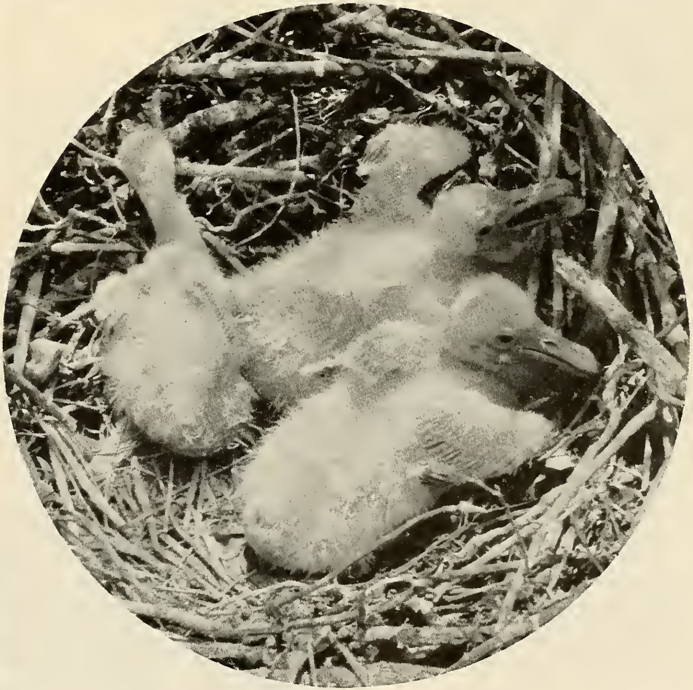
Spoonbills frequently raise their wings for balancing when moving about in the treetops. They present a colorful picture in flight, with the pink of their plumage outlined against the blue of the sky. The dark carmine shows beautifully on the wings with each downstroke, and is particularly vivid when a flying bird makes a sudden turn at close range. The spoonbill holds its neck straight in full flight, unlike its heron and egret neighbors. When coming in for a landing, the bill is pointed downward.

Leaving the islands of the spoonbills was like leaving a beautiful flower garden. The vivid markings on the bird's wings, in contrast with their delicate pink plumage, presented a sight long to be remembered. That departure was made on a June day in 1941 and was my farewell to the "pink curlews," for in the intervening years not a single roseate spoonbill has come my way.

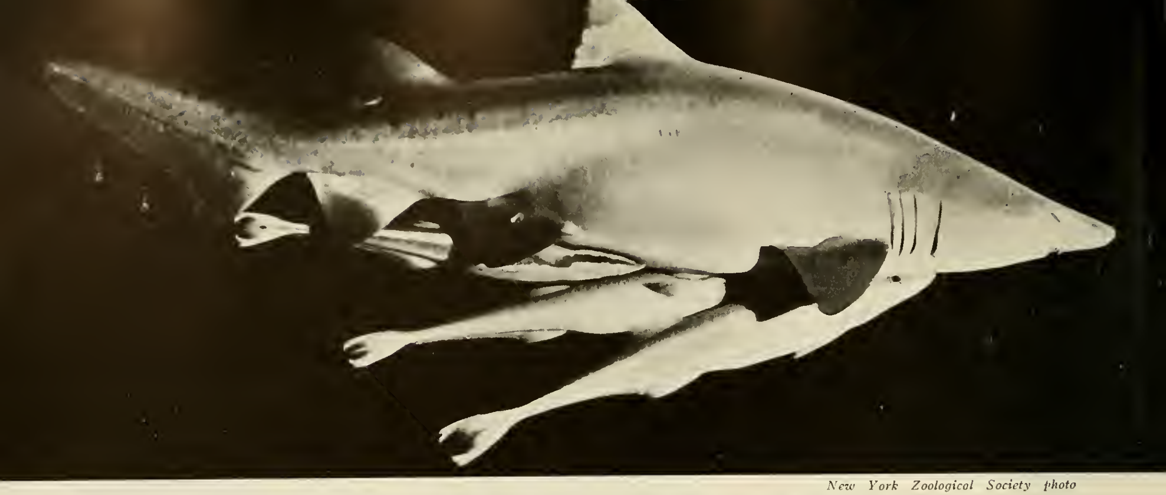
* * *

Spoonbills in flight can be seen among other large birds in the entrance exhibit to the Hall of the Biology of Birds in the American Museum of Natural History.—Ed.

◄ ROSEATE SPOONBILLS and an American egret in Galveston Bay, Texas. The spatula-shaped bills are clearly seen when the birds perch in the treetops



▼ A FEW DAYS OLD: At birth there is no sign of the spoon-shaped bill that distinguishes the adults



New York Zoological Society photo

▲ REMORAS attached to a Sand Shark. They will share the shark's meal when he finds it

HITCHHIKER of the Sea

The fish that rides free to its meals lends itself to one of the strangest fishing methods known

By N. J. BERRILL
McGill University

WHEN Columbus returned to the Caribbean the year after his first voyage of discovery, he was in less of a hurry to get back to Spain and took more time to explore. He found Cuba to be a lovely island, and it was during a leisurely voyage among the islets off the south coast, which he called the Gardens of the Queen, that Indians came in a canoe to hunt turtle with a fish.

The Admiral himself watched while they fastened a cord to the tail of a curious fish and let it go down into the sea with the line held to the canoe. The explorers who were with him recorded their observations as follows: These fish "have a large mouth all full of suckers like a cuttlefish, and they are very daring, as ferrets are here. And when they are thrown into the water, they go to fasten themselves on some fish; of these they do not leave hold in the water but only when they are pulled out . . . they had one of these fish fastened on the bottom of a large turtle, and they waited to get it into the canoe." The description is not quite accurate, for the suckers are not in the mouth but on the top of the head. And while Columbus was not familiar with the fish, it is one that was well known to the ancient civilizations of the Mediterranean.

The fish was the Remora (pronounced REM-o-ra), otherwise known as the Shark-sucker. Its peculiarity is that its dorsal fin, which starts life like the dorsal fin of most other fishes, changes into a complex sucker or adhesive organ shaped like the sole of a shoe and divided into many compartments. The fish uses the sucker to hitchhike from one place to another. By means of suction it attaches itself to any convenient large swimmer of the seas, whether it be a shark, turtle, porpoise, or even the manatee, which Columbus called the mermaid. This is pure laziness, for what the remora gets is a free ride to a free meal. It attaches by the back of its head to the lower side of its traveling companion and hangs on till the meal is reached. Then it drops off long enough to join in the feast, after which it reattaches and goes for another ride. And there is little doubt that the hull of a ship looks as good to the remora as the belly of a shark.

There is a very old legend that the remora can slow down sailing vessels and even stop them altogether. We repeatedly find the idea in medieval and classical literature, and the fish was often drawn on Greek and Roman vases. In fact, the death of the Emperor Caligula was attributed indirectly to a remora, which was supposed to have fastened to his great galley and held it back while the rest of his fleet escaped. Its scientific name, *Echeneis,* itself means "holding back," and older writers usually referred to it as the Ship-holder. The remora is never big enough to exert much force against a moving boat. One kind reaches a length of about sixteen inches, and another about three feet. There is little doubt, however, that a rowboat or small sailboat would be slowed down by one of these underwater hitchhikers, and several of them might make their presence known to the oarsmen of a larger boat. Mark Anthony's delay and defeat at the battle of Actium was also supposed to have been caused by the attachment of many suckerfish to his galleys. Perhaps any excuse was better than none, especially when Cleopatra may have been the real reason.

The remora fastens itself very tightly. It has been reported, for example, that when one is attached to the glass of an aquarium, it will hold so firmly that the sucker is left attached to the glass, and the fish is so injured that it dies.

Another old name for the suckerfish is the "Reversus," from the mistaken idea that the fish swims on its back. It does give that impression, but it actually swims in the normal manner.

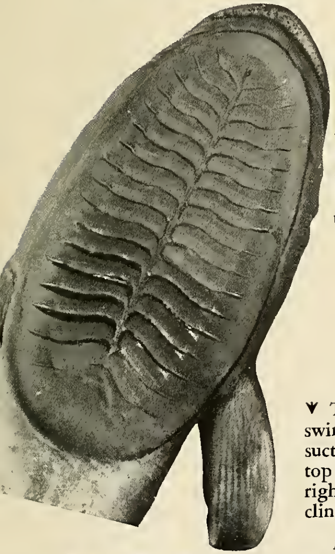
According to reports left by Columbus and his companions, the Caribbean Indians caught these curious fish when they were young and raised them in pools. Before and after a hunting trip below the sea, the Indians would talk to the fish, cajoling and praising them as though they could understand.

There is something very strange in the widespread use of this method of fishing. It reflects either the wanderings of mankind or the tendency of men throughout the ages to use their ingenuity in every possible way to obtain food beyond their reach. There is no doubt that man is inherently lazy and will make someone work for him if he can. But is it not surprising that the remora is employed to hunt fishes, turtles, and other sea animals, with a cord fastened to its tail, not just in the West Indies but in Malaya, China, the Spice Islands, and northeastern Australia? Chinese, Polynesians, Melanesians, and Australian aborigines isolated from the rest of the world for thousands of years, as well as Carib and Lucayan Indians of the West Indies, all use or have used the same fish in the same way. It does seem more reasonable to believe that the statement "Great minds think alike" accounts for this widespread practice, rather than that the method was discovered only once and was then carried over so large a part of the world.

The aborigines of the Barrier Reef angle for suckerfish with hooks made from pearl shell or bone fastened to woven bark lines. Then they fasten the fish by the tail and keep it in shallow water until it is time to hunt for turtles. In leashing the fish, a hole is made at the base of the tail fin by means of a turtle bone, and one end of a very long piece of string is inserted and made fast to the tail. A short piece of string is also passed through the mouth and out the gills, securing the head end, and the fish is slung over the side of the canoe. When a turtle is sighted, the short piece is pulled out of the mouth, and away the remora goes. As a rule, just before the fish is released, the disk and shoulders of the sucker are scrubbed with dry sand to remove the slime and excite the fish.

So long as the line is kept taut, the remora cannot let go of anything it has caught, and the size of the turtle or fish that can be captured is limited only by the strength of the line and the breaking strain of the remora itself. Turtles up to 100 pounds have been hauled to the surface in this way. But when the turtle is very large and clings to the bottom (and green turtles can weigh several hundredweight!), the natives dive overboard and follow the line down to the turtle to secure it with a rope.

One little difference stands out between the customs of the aborigines of Australia and the gentle Indians described by Columbus. Whereas the Indians endowed the remora with intelligent understanding and treated the fish humanely, the Australian aborigines at the end of a day's fishing eat the remora, too.



◀ THE DISC by which the shark sucker attaches itself is a greatly modified fin. Suction is created by the many slits

Woody Williams photo

▼ THE REMORA appears to swim upside down, but the suction disc is really on the top of the head. The fish at right was photographed while clinging to the glass of a tank

New York Zoological Society photo

For a detailed account of the use of remora in native fishing, the reader is referred to Dr. E. W. Gudger's study published in *The American-Naturalist* in three installments: July-Aug., 1919, Sept.-Oct., 1919, and Nov.-Dec., 1919.

Can Music Charm Snakes?

By Bucky McDonnell

An account in which an amateur naturalist and a professional scientist arrive at opposite conclusions

I SHALL tell you exactly what I observed and then, because science says, "No, snakes cannot even hear music," you will hear from a man who states his reasons for doubting the interpretations I offer. I do not promise that it will be easy for you to make up your own mind.

One morning about 10 o'clock in the early part of September, I was playing my violin on the southeast shore of Lake Tiorati, west of the Bear Mountain Bridge, New York. I was right at the edge of the dam that forms the bank on the southeast end of the lake. My friend, Art Bisson, who is a great music lover, was sitting on a camp chair, holding the music so that I could play it while looking over his shoulder from behind.

I had played several classical and semiclassical numbers, when suddenly my friend started to fall over backward, chair and all. I stepped aside and looked down to see what had caused him to turn turtle so easily. A big snake was half curled up where the chair had stood. Art said he felt it weaving in and out around his bare feet. We disposed of the snake.

Since there were many snakes in that neighborhood, we did not see anything strange about this. Art again took his position holding the music, and I continued to play. He kept looking around for more snakes, and before long he said, "Look, Bucky, here comes another one right up to me." I stopped playing. Art got rid of that snake and then sat down a third time.

It wasn't long before he said, "Bucky, you are a snake charmer. Here come two more snakes."

I did not think I was a snake charmer, so I stopped playing and watched. In a minute or two, they turned and started to crawl back to the woods. Art said, "Start playing, Bucky." I started playing, from memory, some of my own compositions. The snakes immediately turned around and came back toward us.

I said, "Well, if I'm a snake charmer, let's see if there are any more snakes," and I started to play. Another big snake came crawling out of the woods, and I watched it as it came toward us. It vibrated to the music I was playing, and as I changed the tempo of the music, it changed its vibrations. We walked around the spot in the clearing where we could watch the snake, and the snake followed me around as I played.

When I stood in one place and played, the snake came to within about six feet of me, curled up, raised its head about five inches, and just sat there like a statue until I got tired playing.

We let this snake crawl back to the woods. But when I picked up my violin and played a final tune, friend snake came back to his original place to listen. This last one, I believe, was a black snake. As I remember it, there was a black snake, a water snake, and several garter snakes that had come out.

This was my first experience, and I did not think there was anything unusual about it. I supposed that others had done it, but one day I was telling the postmaster in our town about it. He also had a camp on Lake Tiorati. He said he had never heard of such a thing, and I told him I would show him.

About two weeks later, I was sitting on a stool near his camp, playing my violin, trying for all I was worth to bring a snake out of the woods. Nothing seemed to happen. The postmaster and his guests started to kid me. Then a boy came around the bend and said, "Did you see that puff adder right back of you?"

I turned around to look, and there the snake was, sitting about three feet from my head on the dam, in exactly the same position as the first snakes I had "charmed." I stopped playing, and soon it went away. I played again, and it came back.

Then I tried something new. I put my violin away and got my mandolin. I played to the snake for about ten minutes. It never made a move to go but seemed to be in a trance.

Since then, I have mentioned this

story to many and have not found anyone who has charmed snakes with a violin or a mandolin. Many people did not believe my story and invited me to demonstrate. I have proved the thing to many of these folks.

Not long ago, my friend Charles Kenny of the New York *Daily Mirror* heard about this. He talked it over with many of his friends, and they all thought it couldn't be done. This was especially true of Herman, Charles Kenny's farmer, who worked on the Kenny's Connecticut farm. Charles Kenny, incidentally, also plays the violin, and Herman knew where there were black snakes.

One day, Charles invited me up to his farm for a week end. I said, "All right, I'll bring the fiddle, but I won't promise anything. I only know that it attracts New York and New Jersey snakes."

At the Kenny farm the following week end, Herman told me of his doubts about snake charming. Charles tried to tell him that I was an honest fellow, but Herman only looked dubious. In addition to my own violin, Charles had five others ready for the demonstration.

Saturday morning was beautiful—warm sunshine and a nice southwest breeze blowing over the countryside. Charles said, "Is it all right for a little snake charming?"

Charles took his fiddle, and I took mine. His wife and son went along. Herman ushered us to a place on the farm that looked like black snake country. Charles and I played together. Nothing happened. We played and played—still nothing happened. Herman seemed satisfied, but Charles still had faith in my word. I concluded that there just weren't any snakes within hearing distance. Herman was sure there was at least one.

We were all about to give up when Charles suggested I play alone. I did, and in about two minutes Herman's eyes almost popped out of his head, and his brow wrinkled. "Mr. Kenny," he said, "look at the big black snake coming along the wall." There was Mr. Black Snake half out of the rocks coming toward me.

I said, "Now you fellows stay here, and I'll go on the other side of the wall. If the snake goes through the field-stone wall, you will know the violin is causing him to do it."

I played on the opposite side and, in about a minute, the black snake went through the wall and crawled to about six feet from me. The snake curled up, raised its head about six inches, and sat as if in a trance. I played to him for about ten minutes.

Herman shook my hand and said, "I'll believe anything you say now, Bucky." Charles was also surprised and impressed. He only seemed to worry that his playing had not appealed to the snake.

Having had these experiences, you may understand that it is a bit difficult for me to reconcile actual observation with expert testimony, which says that snakes do not have an eardrum and cannot be assumed to hear music.

* * *

Charles M. Bogert, Chairman of the Department of Reptiles and Amphibians at the American Museum of Natural History, comments on my observations as follows:

"Several investigations have shown that hearing in snakes is defective, if not altogether absent. And it is well known that the flutelike instrument of Hindu 'snake charmers' has nothing to do with the reactions of the cobras used in such spectacles. These snakes characteristically raise the forward portion of the body and spread the so-called hood when disturbed. They simply focus their attention on the moving object nearest to them and follow its movements. The cobra would perform its 'swaying dance' in front of the swaying fakir in the same manner regardless of whether the instrument were played or not.

"Unfortunately, some of the scientific experiments performed to test the hearing of snakes have not been sufficiently well controlled to prove very much. E. Mangold reported that in 1913, when a trumpet was sounded near snakes, there were changes in the breathing rate and other responses. Ten years later, F. B. Manning made tests with rattlesnakes and found that they were unaffected by loud sounds (in octaves with vibration rates from 43 to 2752 per second) produced in a receiver scarcely a foot away from their heads, except in the case of the lowest notes. A Japanese investigator, Ryo Kuroda, observed the breathing responses of nineteen different kinds of snakes and obtained no evidence that they could hear a loud bell.

"One of the difficulties in controlling such experiments lies in the fact that vibrations from sound are transmitted to the body of the snake through the substratum—the floor of the cage in a laboratory and the ground in natural surroundings. This accounts for the apparent hearing in snakes in spite of the fact they have no tympanum, or eardrum. The bone that ordinarily leads from the inner ear to this membrane in other reptiles is in most snakes attached at its outer end to the bone that forms the support for the lower jaw. Thus the response that Manning obtained with the low notes could have resulted from vibrations transmitted through the body of the snake to nerves more closely associated with the sense of touch.

"A somewhat more reliable way of finding out whether snakes actually hear was employed by E. D. Adrian in 1938. Using suitable apparatus to detect nerve impulses, he found that loud sounds failed to produce any kind of activity in the nerve known to be concerned with hearing in other vertebrates.

"Inasmuch as the sounds produced by Mr. McDonnell's violin or mandolin could have been transmitted through the ground to the tactile nerves of the snake, the question of whether snakes can actually hear in the ordinary sense of the word is perhaps more or less academic. It does seem doubtful, however, whether vibrations of the intensity produced by the musical instruments mentioned could have carried for any distance into the 'woods.' If these vibrations were transmitted to the body of the snake, why should it respond by approaching the source of the sound? I know of no evidence to indicate that snakes employ auditory cues in finding either their prey or their mates.

"On the other hand, black snakes (*Coluber constrictor*) are apparently attracted during the mating season by movement. Several naturalists have observed that these snakes will sometimes approach and investigate the movements of a person. In Arizona, Mr. William Woodin, III and I were trying to capture a racer (*Masticophis flagellum*) by approaching it slowly in order not to frighten it. As we crouched on opposite sides of the motionless snake a few feet away from each of us, it suddenly started to crawl with moderate speed in the direction of Mr. Woodin, who remained as still as possible. To his astonishment, the snake paused briefly as it reached his trouser leg, and then, with rather deliberate movements, seized with its mouth a fold of Mr. Woodin's trousers. Seemingly the action was an investigatory one, although the interpretation of such field observations is of necessity speculative.

"The point I wish to make, however, is that the sounds from the musical instruments may have had nothing to do with the behavior of Mr. McDonnell's snakes. The behavior of the black snake suggests the possibility that the movements involved in the playing of the instruments might have attracted the snake. My guess is that if he had gone through the motions of playing without producing any music, the snakes would have moved in to investigate just as readily as they did when sounds were emanating from the violin or mandolin.

"Mr. McDonnell does not mention having kept a careful record of the times and conditions when he may have sat playing his instruments without attracting snakes. Anyone playing a musical instrument near Lake Tiorati, or just sitting, for that matter, is almost certain to see a snake from time to time. No information is supplied here to exclude the possibility that the snakes' vision was involved, as pointed out above. And absurd though it may seem, olfaction should not be completely ruled out. Odors indetectable to human nostrils certainly register in the olfactory organs of a snake, but this is unlikely to explain the attraction of a violin or mandolin.

"Quite candidly, on a basis of what is known about the nervous system and the behavior of snakes, it is unbelievable to me that the interpretation offered by Mr. McDonnell is correct. However, in expressing my skepticism, I am not seeking to deter anyone from adding to our knowledge concerning the creatures of the wild. I am only urging that observations be reported objectively, with a clear distinction made between what was actually seen and what was merely inferred—perhaps erroneously. Also it is necessary that the circumstances surrounding the observations be given in some detail."

LUNGLESS SALAMANDERS

Continued from page 304

"bridge" (if one ever existed) across the Atlantic. Thence they could conceivably have migrated to Europe, where they are now found. It seems unlikely that the European species could have been accidentally carried in ships, because salamanders are not known to "hitchhike" with cargo the way some other animals do. Also, it would be hard to explain how the European species could have split into two races in the short interval since the earliest voyages.

Today about 85 species and subspecies of plethodontids are known from the United States. There are many species in Mexico and Central and South America. New species are constantly being described by the more than 20 salamander detectives investigating salamander abodes in the different parts of the country. They study salamanders meticulously and often find that among uniform patterned salamanders and those otherwise alike in nature, several species and subspecies are discernible after close study, including the use of such tools as statistical analysis.

Herpetologists are often impressed by the variety of patterns and colors that often blend into a salamander's background. For example, Moore's salamander, *Leurognathus marmorata*, is so mottled above with shades of buff and gray that the salamander is difficult to discriminate from the stream bottom. On the other hand, contrasting characters are not so easily explained. The red-cheeked salamander, *Plethodon jordani*, appears to have rouged its jaws, in contrast to the deep blue-black body. The yellow-blotched salamander, *Ensatina croceater*, vividly-hued with black and orange blotches, lives in seclusion in leaf mold and beneath rotting logs in southwestern California.

Voice plays no part in the breeding process of salamanders. Actually, they have no vocal cords. But this did not prevent Professor C. C. Abbott, usually a careful zoologist, from brashly describing one of the large salamanders as having "a clear, bell-like note . . . It is a true hylodes note . . . They call, whistle, or give tongue, as you choose to express it, only in spring and at the time when the females are depositing their eggs." The call was obviously a frog call, probably a hiding spring peeper, *Hyla crucifer*. Many observers have heard faint squeaks emanate from plethodontids that were roughly handled. In all these cases the sound was probably accidental and associated with a sudden emptying of the mouth cavity. Some salamanders will go into a "death feint" when handled. This cataleptic state lasts but a few minutes, and a sudden touch or movement will arouse the creature to activity again.

It is difficult to believe that the concerted study of these small amphibians has consumed a substantial segment from the lifetime of such famous amphibiologists as Dr. H. H. Wilder and his wife, the late Dr. G. K. Noble, Dr. E. R. Dunn, Dr. Sherman C. Bishop, and many others. What has prompted these scientists to labor on salamanders, of all the manifold living forms, makes interesting speculation. Actually, plethodontids are not of any real economic value outside of their negligible insectivorous habits. Their martyrdom to science should be their most important commendation. Much has been written about these creatures, from Benvenuto Cellini's musings in 1524 over why salamanders issued out of a fireplace, to Nelson G. Hairston's excellent ecological study of plethodontids in the southern Appalachians in 1949. But far more information remains shrouded in their secretive habits.

European folklore of several centuries ago tells us that salamanders gamboled in fires without getting burned. Even today we hear people repeat the same myth, as if nothing has been learned about the creatures in all these years. Many questions remain unanswered, particularly concerning their reproductive habits. Two species (*Hydromantes genei italicus* and *Oedipus adspersus*) give birth to living young. Diligence and specialized scientific training will be necessary to solve some of the riddles. But one thing is certain—both the specialist and the amateur naturalist will always take pleasure in the pretty colors and spritely nature of the plethodontid salamanders.

EARLY "MISSING LINKS" FROM AFRICA

Continued from page 309

in association with a baboon that was contemporaneous with *Plesianthropus*. But caution bids us wait. This problem demands and will receive close study through many related branches of science. The hyena may prove to be a South African survivor from the Pliocene. In the next few years, the South African fauna may be correlated with the record from China, India, Java, and elsewhere, and then a much more definite answer can be given.

Dr. Broom studied his three genera and noted that they differed from apes in many ways, and in each of these ways they resembled human beings. They substantiated the conclusion that man and the anthropoid apes forked apart not a few hundred thousand years ago but perhaps many millions. With their small canine teeth and short jaws, these creatures were almost men. Their nearly human limb bones indicated that they could stand up and walk erect and that they did so to the exclusion of other forms of locomotion. Dr. Broom's findings thus far indicate that the female *Plesianthropus* had a brain with a volume of from 450 to 500 cubic centimeters, about the size of a large fist. It was thus not far from the range of the chimpanzee or the gorilla, the average for the female gorilla being 435 cubic centimeters. Last year a large *Plesianthropus* jaw was found, and Dr. Broom calculated that a skull large enough to go with that jaw must have contained a brain of 650 or perhaps 700 cubic centimeters—not so far below the capacity of 900 cubic centimeters ascribed to Java Man (*Pithecanthropus erectus*). Modern man usually has a brain of 1200 to 1500 cubic centimeters, although the extreme range is from 850 to over 2000. Anatole France had a 1100-cubic-centimeter brain and Dean Swift's was over 2000 cubic centimeters. Dr. Broom has noted that in many primitive races the brain may be as small as 1000 cubic centimeters or less, although a pre-Bushman race had the largest brains in the history of the world.

In structure the Sterkfontein fos-

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LUNGLESS SALAMANDERS

sil's brains were not unhuman. Dr. G. W. H. Schepers, a brilliant student of Dr. Dart's who became a medical practitioner and a well-known anatomist, studied with minute care the convolutions in casts of the brain cases of the Sterkfontein, Kromdraai, and Taungs skulls. He decided that the front two-thirds of *Plesianthropus* was "much more man-like than apelike." The latter one-third was subhuman, he found, but at that, it approached the human brain in form. From his study of the brain cases, Dr. Schepers decided that *Plesianthropus* had some sort of speech, and that it could use its hands for manipulation of tools, rude though such implements undoubtedly were. Prof. W. E. Le Gros Clark thinks there is no evidence of speech in the brain cast.

The study, Dr. Schepers said, suggested that "these fossil primates were closely related to man's ancestral stock, if not actually Pliocene or Pleistocene surviving representatives of his Miocene or Pliocene evolutionary predecessor." No creature, he believed, could be accepted as human unless it could stand up and thus relieve its hands from the necessity for aiding in locomotion and, secondly, until it had developed some sort of speech or other means of communication. The brain casts of Dr. Broom's fossils indicated that they may have scored like little men on both points.

"The least we can say," wrote Schepers, "is that these fossil types were capable of functioning in the erect posture, of using their hands in a limited sense for skilled movements not associated with progression, of interpreting their immediately visible, palpable, and audible environment in such detail and with such discrimination that they had the subject matter for articulate speech well under control, and, having developed motoric centers for the appropriate application, they were also capable of communicating the acquired information to their families, friends, and neighbors, thus establishing one of the first bonds of man's complex social life. With all these attributes, they must have been virtually true human beings."

Emotion and Science

So vulnerable is man to vanity that some will resist the notion that these little creatures could have been our direct ancestors. To them, the fossil hunter appears always to be searching for skeletons in the human closet—unworthy forebears to sully the proud human escutcheon. Theological arguments are sometimes enlisted to support the thesis that Man, God's special creation, must not be linked with anything so lowly as a monkey. Those who yield to this conceit may take comfort in the admitted possibility that the Australopithecinae may be only our grand-uncles—closely related collateral beings not forming an integral part of the direct human stem. This may satisfy those who want to prolong the argument that we alone are God's own creatures. But meanwhile, more and more missing links are being discovered. And those who search for them are not made atheists by the fact that they are studying a creative process that took millions of years instead of an instant. Dr. Broom, for example, believes that in evolution there is a Plan and a Planner.

Naturally, the closer a given skull comes to being an exactly intermediate form, the more intense will be the argument as to whether it belongs on one side of the line or the other. Scientists sometimes differ in their interpretation of the details, but on the broad issues, there is more and more agreement as to the proper place of these important South African specimens in the evolutionary sequence. They belong much farther back than the other fossil men of which more has been written — *Pithecanthropus erectus*, Peking Man, and the others. They are apparently older than any other beings that show definite human-like traits. If you should meet them today on the South African desert, you might not at once call them human. But there is good reason to believe that they walked like men, that they used simple tools, and that they even may have talked.

BOOKS *Continued from page 295*

is a necessary adjunct to identification and to the study of insects.

The book is well arranged and satisfactorily illustrated. It is written for the amateur, and it will prove most useful to beginning students in entomology, particularly in the high school grades. Like other books of its kind, it contains much information not previously included in popular books, and the layman will find it interesting reading.

C. H. Curran

This land of ours

------- by Maxwell S. Stewart

Public Affairs Committee, Inc., $.30
32 pp. 36 illustrations

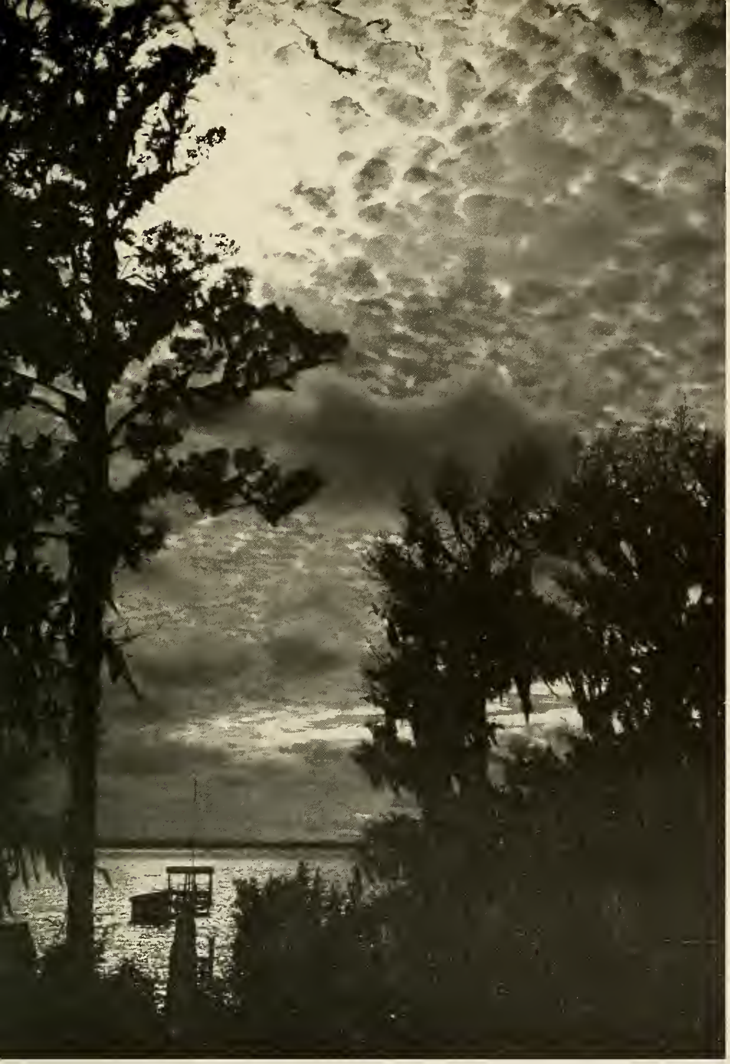
This unit in the extensive Public Affairs pamphlet series is addressed to and seeks to convince the city dweller that wise use of our natural resources is of vital importance to him. His dependence on the products of the land is emphasized in a series of beautiful photographs with simple explanatory captions. These cover two very different types of resources: those that are the products of a healthy land and with proper care are inexhaustible, like water, foodstuffs, and wood products; and those like coal, gas, oil, and the metallic ores that are subject to continuous depletion.

Photographs of healthy land and water and their living communities are interestingly contrasted with those showing the appearance of such areas after years of abuse. Even to laymen these should largely tell their own story.

In closing, the author points out that six out of every ten voters now live in a city and that it is therefore important for the city dweller to actively support the governmental efforts to help resource owners put conservation measures into practice.

Unfortunately, the whole presentation leans too heavily on the questionable assumption that everyone abhors resource waste and will do all he can to stop it once it is called to his attention. Human nature being what it is, the pamphlet would probably have gone much further in producing the results the Committee seems to desire if more space could have been devoted to proving that natural resource exhaustion hits the city man first, hardest, and where it hurts the most, namely in his standard of living. Much good, however, could come from a wide dissemination of this excellent piece of literature, and it is to be regretted that relatively few of the 90 million city dwellers who need its message most are likely ever to see this pamphlet, unless quantity production can lower the cost of distribution.

Richard H. Pough



At the End of a HURRICANE

By Harrison M. Reed, Jr.

PAPERS run headlines telling of a hurricane in Florida or elsewhere, with lurid accounts of death and destruction well illustrated with vivid pictures covering the disaster phase of the event. That is news! But what about the beauty of the storm? Many witnesses who have waited anxiously for a storm of this kind to pass have remarked that there was a certain grim grandeur about it all.

In Jacksonville, Florida, on the night of August 26, 1949, a hurricane came across the state from a southwesterly direction to hit this city "mildly," so the Weather Bureau said. But lights and phones went out, and highways were blocked by fallen trees and debris. By the morning of the 27th the east shore of the St. Johns River on the fashionable South Side was a riot of broken docks and tangled timbers as a result of winds that blew at 70 miles an hour with occasional gusts that reached a known velocity of 85 miles an hour. Then suddenly, on the afternoon of the 28th, the sun peeped through.

Here is an actual photograph of the tail end of a hurricane as seen over the St. Johns River from nearby San Jose community. Many witnessed this sight from various vantage points, but this seems to have been the only photographic record of the event. The local Weather Bureau states that this ending is typical of hurricanes. Suddenly, while the wind was still high, the rain squalls ceased.

The cloud layers appeared to separate, and while the lower strata (fractostratus) scudded madly onward, the upper strata (altocumulus) began to break up or coagulate into a flying mass of small fleecy clouds at an altitude of between 7000 and 8000 feet. Almost before a camera could be set up, the storm was over. Forty minutes after this picture was taken blue sky was a common and most gladdening sight, with only a few black rain clouds remaining in the distance (nimbo-stratus, seen in the background of the picture). Everywhere, of course, there was evidence of destruction, and the roar of the storm still rang in the viewer's ears. But they who came out to survey the damage were impressed by the magnificent cloud effect displayed in this mood of the elements as "Dame Nature" gathered up her winds, and a grateful people thanked their Maker that the hurricane had not been worse.

LETTERS

Continued from page 290

suet in a crevice in the tree, in different places.

Chickadees, Starlings, Blue Jays, and Woodpeckers all came for this suet, but the Nuthatch was the only bird that appeared to hide the food for possible future consumption. We thought that this information might be of some interest.

Charles and Irene Munzinger.
Oakland, New Jersey.

The following comments are offered by Dr. John T. Zimmer of the American Museum's Bird Department:

This interesting trait of the White-breasted Nuthatch has long been known, although the origin of the practice is not clear. The chances are that the Nuthatches do not remember the caches as a future source of food in case of shortage. It is more likely that if the store is again visited, it is in the course of a general search for food, when it is as much a pleasant surprise to the birds as any other unexpected discovery.

The Nuthatches have another procedure that suggests a possible explanation of the behavior under discussion. Since their bills are not heavy enough to be very efficient crushing organs, certain harder items in their diet may be carried off and held under foot or wedged in a crevice where they can be hammered open. Inedible portions may be left where they were lodged, being of no further use. It is not impossible that the same treatment might be accorded softer bits of food, especially if there were an abundant supply waiting competitive attention. The birds' concentration on getting a full share of the main stock might drive out recollection of the previous cache.

This is pure speculation, of course, and the concealment of food may have had some other origin. Various other birds have the same trait. It would be interesting to learn if the Nuthatches were ever seen to return directly to their stores when food was not readily available elsewhere.

Foundling Seal

Sirs:

Almost every year during the past 30 years from one to six baby seals have been driven ashore in stormy weather on Parsons Beach, Kennebunk, Maine. They are a week or less old, and until last year, no one succeeded in keeping one alive. The seal shown in this photograph was raised on a bottle. It became as dependent and affectionate as a dog and very friendly with the dog. It had free access to the river, and after about four months it departed for the sea.

A lobsterman near Jonesport, Maine, had an almost identical experience, but I do not know whether that seal departed for the sea or remained as a family pet.

New York, N. Y. Joseph Parsons.

Museum Visitors

More than 2,000,000 persons visited the American Museum during the past twelve months, according to Wayne M. Faunce, Vice-Director. Approximately 70,000,000 have visited the Museum since 1900. Annual attendance has more than quadrupled since that date and has nearly doubled in the past two decades.

In the Planetarium

During September, the subject of the lecture at the Hayden Planetarium will be "Autumn Skies."

Astronomy and Navigation

Five series of popular and informal lectures occurring once a week will begin at the Hayden Planetarium in September and October. These courses are carefully designed to clarify basic concepts in an authoritative yet not too technical manner. The introductory sessions, which provide an opportunity to ask questions regarding the scope of each course, are open to the public without change, as follows:

Modern Celestial Navigation	Sept. 20
Applied Navigation . . .	Sept. 25
Astronomy without Mathematics	Oct. 3
Young People's Astronomy and Parents' Refresher Course	Oct. 14
Star Identification	Oct. 19

All of the lectures begin at 7:15 p.m. except the Young People's Astronomy and Parents' Refresher Course, which is held at 9:45 in the morning.

A pamphlet giving additional information about these streamlined courses can be procured by addressing a request to The Hayden Planetarium, 81st Street and Central Park West, New York 24, N. Y.

Total Eclipse of Moon

There will be a total lunar eclipse on September 25, which will be visible in all parts of the United States.

Special Exhibits at the American Museum

Through Oct. 1

Famous Animals You Should Know

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Through Oct. 1

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October

NATURAL HISTORY

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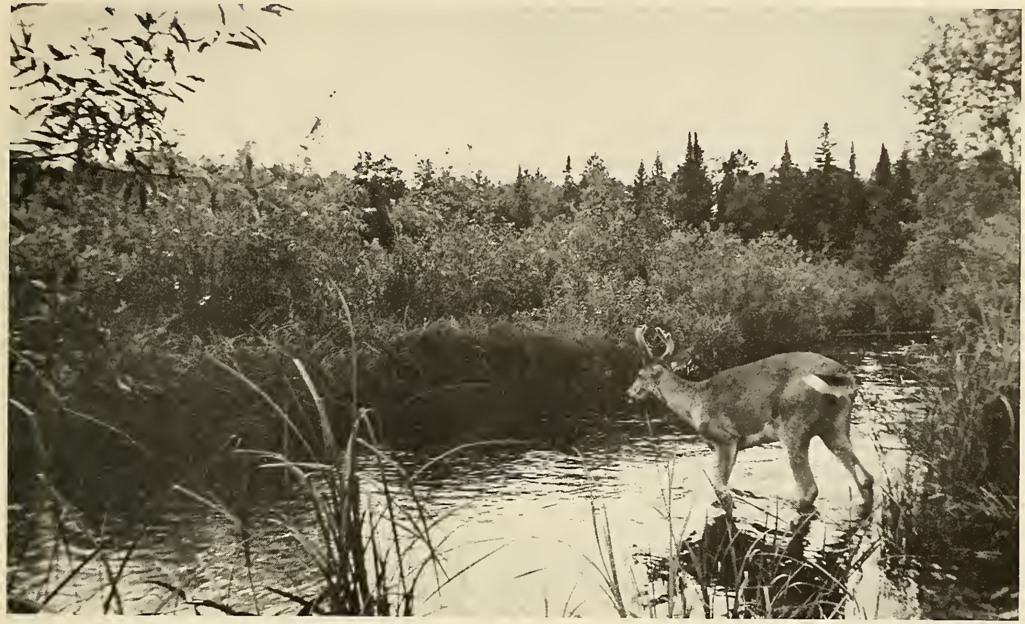
LETTERS



Mighty Mississippi

SIRS:

Some of your readers may be interested in this photograph of the mighty Mississippi. Note that at this point, deer wade across the river with impunity. I photographed this scene last year near Lake Itasca, the source of the Mississippi, in northern Minnesota.

BATES M. STOVALL

Alexandria, Va.

Barter Mart

SIRS:

I am making for the local archaeological society, of which I am a director, a collection of minerals and rocks typical of those used by the Indians and early inhabitants of North America. I still need for this collection, specimens of obsidian, novaculite, jasper, and the several varieties of chalcedony (as described in Dana's *Mineralogy*). I wonder if any of your readers can help me in obtaining any of these. I can pay a moderate amount for good specimens but would prefer to trade minerals and rocks from the Missouri Ozarks for them.

I do not need perfect artifacts but can use broken pieces or even chunks of unworked material to show the general appearance of these rocks and minerals.

Any help to make this a good collection will be greatly appreciated.

C. H. TURNER

Springfield, Mo.

Flowers from the Crater

SIRS:

I am a student at Hiroshima-High-Normal School and am very much interested in collecting wild flowers. At Hiroshima Civil Information Education Library I found NATURAL HISTORY Magazine and am delighted with it. Within beautiful and good pages I can easily see about the animals and plants of the United States.

I hope it may be possible for you to introduce to me an amateur plant collector with whom I could exchange specimens. I could send him the wild flowers of Hiroshima City.

(Mr.) TERUHIKO KIDO
Age 20

Hiroshima, Japan

NATURAL HISTORY Magazine will be glad to forward to Mr. Kido and Mr. Turner any communications from readers interested in flowers and minerals respectively. Address: care of NATURAL HISTORY Magazine, 79th St. and Central Park West, New York 24, N. Y.

Jumping Fishes

SIRS:

In the June issue of NATURAL HISTORY you published a short article entitled "Jumping Fishes," by Bucky McDonnell, in which the author described how fishes can be made to jump out of the water by striking the gunnels of a canoe sharply with a paddle. I am wondering whether a slightly different experience I have had with fishes may interest your readers.

For years it was both my custom and pleasure to return to a cottage on the Susquehanna River a few miles north of the Pennsylvania-New York line. A college classmate joined me one summer, and we frequently rowed four or five miles upriver for corn roasts, dances, etc. In this part of the river there were several small rapids to be navigated, and to help us through these tough spots in

NOTICE—Readers are encouraged to submit their own photographs of natural history subjects. Those selected for publication on these pages will be paid for at $3.00 each, with full credit to the photographer. Return postage must be included.

the dark we used a fairly strong auto headlight attached to a post in the bow or stern of our four-oared steel rowboat.

Some occasions required a bit more fancy dress than usual, and my story starts with a black night on which we were wearing white shirts. My friend was rowing in the bow of the boat when, all of a sudden, he got a wet slap in the back with an eight- or nine-inch black bass. The fish had jumped at least 2½ feet out of the water and then dropped to the bottom of the boat.

It is well known that fish are attracted by light, so we decided that our headlight had been responsible for this. Either it had made a bright spot on the boat or on my friend's shirt, or the light itself had attracted the fish and made it jump.

We then made trips at night to check our theories. We determined that if the light played only inside the boat, leaving the water dark all around, the results were surer. I should add, however, that there was nothing to boast about either as to the size or the number of the fishes.

Having proved our theory, we began to wonder whether by chance the regular nightly maneuvers of another boat we had seen had a similar purpose. It would slowly work its way up and down on the far side of the river, with a lantern in the bottom, looking like a phantom ship. There were laws about night fishing, and we felt that it was really the other man's business if he wanted to break them, so we went slowly. In time, however, we made his acquaintance. He lived in a small shack downriver. We got at the truth during a yarn-swapping session. With little idea of being believed, I timidly told of our experience of catching fish with a light in the boat. Our friend then confided that we had guessed correctly. Having only nights available, he was supplying a part of his food requirements in this way. He said there was nothing unusual about catching fish by means of a light, and he cited a case of a sunken canal boat that tipped considerably but had a dry deck area behind one gunnel. People would walk that deck at night with a lantern shielded behind the gunnel, and fish would be attracted. They would jump toward the light, and some would land on the deck and be carted home.

I was most interested in Bucky McDonnell's incident, but I do not have any explanation for these things. After many years of varied fishing, I am convinced that fishes rate high in the stupidity scale and that no one knows what is in their minds. They won't touch a good-looking worm but will take a dry fly and a cigarette butt on the same line (two hooks, of course) in the same cast. My one and only "muskie" (18¾ pounds) cost me about $25 a pound, taking all the trips and all the expenses into account—and then along comes one of them and gets himself caught on a stringer hanging to a post of the dock. But don't get me wrong. There is no thrill like seven inches of brook trout with his tail kinked against a fast-flowing stream and you on a slippery rock with light equipment. . . .

W. R. Atwood

Westfield, N. J.

Catching fish by means of a varnished board sloping into the water from the edge of a boat is an ancient practice in China, where it was reported at least as early as 1685. Moonlight glittering on the board is frequently mentioned as one of the circumstances making it more likely that a fish will propel itself into the boat.

In a comprehensive article entitled "Fooling the Fishes," published in *The Scientific Monthly* for April, 1937, Dr. E. W. Gudger raised the interesting question of whether this method of fishing was carried from one region to another all the way to the Congo, where it has been observed in modified form. He finds no mention of the practice between Annam, or perhaps India, and the Congo basin. He concludes that, in all probability, the method was developed independently in different parts of the world.

Plausibility is lent this conclusion by Mr. Atwood's own story, above. Where there is intellectual curiosity, there is development in the arts of fishing. Like most fishing techniques, this one is designed to make the fish catch himself. Mr. Atwood clearly discovered the efficacy of a light in attracting fishes and unearthed the only instance resembling the Chinese varnished board technique that we have heard of in the United States.—Ed.

Dwarf Birds?

Sirs:

My interest in birds has spread to the rest of the family, including my nine-year-old son. Recently he saw a person whose growth had been stunted for some reason. Later he asked me if there were ever dwarfs among the birds. Could your ornithological department help me in answering that inquiry? Thank you.

Mrs. J. C. Hageman.

Lorain, O.

The following comments are offered by Dr. John T. Zimmer of the American Museum's Bird Department:

It is quite possible that dwarf individuals may hatch on occasion, but certainly very few if any of them survive. Among the many thousands of birds that have passed through my hands, I have never seen one that I could call a true dwarf. There is, of course, individual variation in size as in other characteristics, the extent of which is different in different species, but it is nevertheless remarkable how small this variation often proves to be.

A notable difference in size may occur between populations of the same species living in different regions, and numerous subspecies have been named on such characteristics. The entire population of the different area is, however, involved and within its own limits of variation is as constant in size as the other. There is also sometimes a notable difference in size between the two sexes of certain

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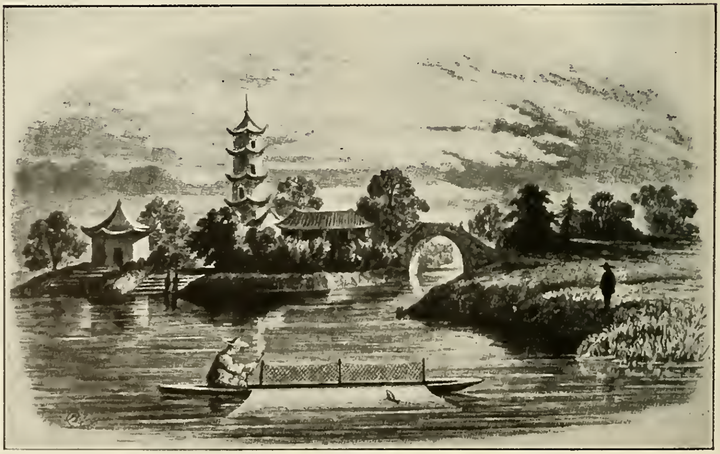

∀ Canvas sometimes took the place of the varnished board, as shown here. The net served to keep the fish from leaping clear over the boat. The artist seems to have erred in putting the moon on the far side of the boat

After Fortune, 1857

NATURAL HISTORY

The Magazine of the American Museum of Natural History

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VOLUME LIX—No. 8
OCTOBER, 1950

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You will find Natural History *Magazine indexed in* Readers' Guide to Periodical Literature *in your library*

THE COVER THIS MONTH

The gorgeous autumn coloration shown in Georgia Engelhard's photograph taken at Tamworth, New Hampshire, reminds us once again of the marvelous living chemistry that produces this aesthetic treat each year. What many persons do not realize is that these colors do not represent the transformation of one substance into another. The red, yellow, and purple substances are present in the leaves all through the year. But they are hidden by the green coloring matter known as chlorophyll until, at the end of the warm season, it diminishes and exposes them. Among these pigments are the derivatives of carotin, and the dye stuffs called anthocyanins (reds and purples) and flavones (yellows).

Perhaps the most pleasing effect is seen when a few green leaves remain, as in this view, and when nature's autumn palette is accented by the gleaming bark of birch, whose frosty whiteness will remain the same through the summer sun and winter snow alike.

This photograph was taken with Ansco Outdoor Color Film, at f 8 and 1/50 second, with an Eastman Kodachrome haze filter.

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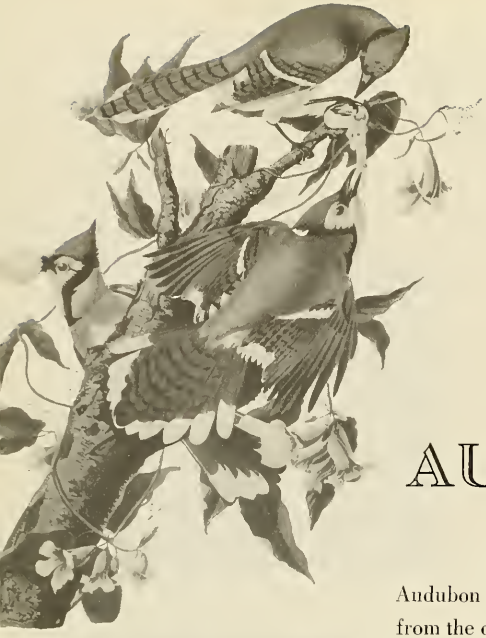

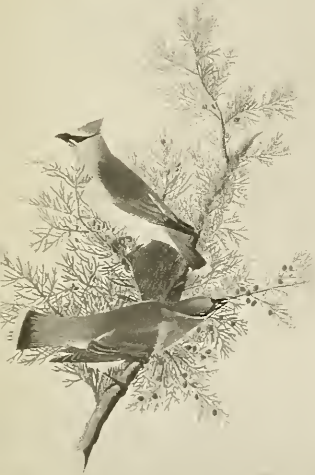

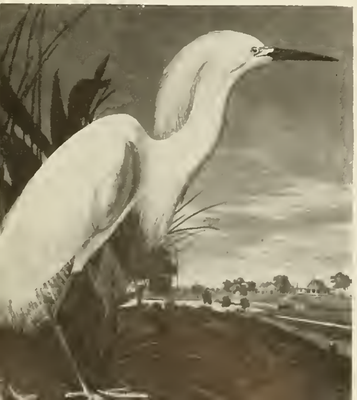

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Science Is a Sacred Cow • Game Abundance

Africa • Fishing • Gems

SCIENCE IS A SACRED COW

by Anthony Standen

E. P. Dutton & Co., Inc.
$2.75, 221 pp.

MR. STANDEN'S blast against scientists and the science that some of them profess has been received generally with whoops of joy by the reviewers in the daily press and with scorn by the critics in the scientific journals. There is no doubt that Mr. Standen is sprightly in his attack and often funny. The pleasure, however, that scientists might be expected to take in his cracks is apt to be somewhat wry. But even the scientists trying to be "objective" (Mr. Standen doubts this state of grace) must admit that the author has a point or two.

What Mr. Standen seems to be objecting to most of the time is that science or scientists are overweening in their claims and are often wrong. He points to a long list of errors stretching back to the beginnings of science. That doesn't impress me very much, since it is well known that scientists spend a large amount of their time altering and perhaps improving the concepts and theories of their predecessors. The fact that someone one or two hundred years ago formulated a generalization that is now discarded doesn't necessarily mean that everything we believe now is similarly doomed for a future ash can. Even Newtonian physics continues to have validity.

Another gripe of Mr. Standen's, especially when dealing—none too gently—with the social sciences, is that they cannot provide the answers to various pressing social questions. No one knows this more acutely than many social scientists. That is one of the reasons they are in the business of trying to find methods that will provide the answers. Of course this won't satisfy Mr. Standen, who seems to think that social scientists will never be able to solve their problems and perhaps should not be permitted to try.

I suppose in the long run, it is a question whether you believe, as Mr. Standen evidently does, that man can arrange his affairs better by intuition or revelation, or you sympathize with the struggle of the scientist to establish a firm foundation of tested and rational understanding as a basis for society.

HARRY L. SHAPIRO

LAST CHANCE IN AFRICA

by Negley Farson

Harcourt Brace, $5.00, 381 pp.

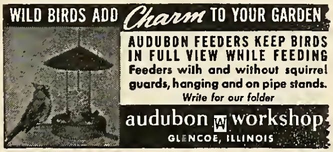
NEGLEY FARSON first visited British East Africa twelve years ago. In 1947, wishing to study the problems of both natives and Europeans, he traveled from Tanganyika to the Abyssinian frontier, visiting tribal chiefs, farmers, government officials, native educators, and Indian merchants. He was astonished at the unsolved issues—educational and economic. He found schools, maintained by the government, by missions, and by literate natives, "up for revision." "The white man should better educate the native for life in Africa"—provide training not only for clerks but artisans. The "frantic desire of the educated Africans is to develop Africanism" (witness Jomo Kenyatta, after seventeen years in Europe, now President of Kenya African Union and the Teachers' College).

There are still a few estates of 100,000 acres, much of which lies fallow. Real agriculture is carried on by farmers who cultivate small holdings intensively. A great majority of the 5,000,000 natives, during six months of the year, are half-starved, due to overpopulation (often 900 to the square mile), crop failure, drought, and a low water level. The native thinks the white man, not "the will of God," is responsible for his misery. To make the hungry native believe in the European's good intentions, Kenya must control erosion and overgrazing. For example, 49,000 Masai, with 700,000 cattle and several million sheep and goats, occupy only 15,000 square miles of land. Never do they kill cattle for food, but drink milk and blood extracted from the neck of the living beasts. These fiercely handsome Nilo-Hamites, renowned for intelligence, dignity, and great bravery, once dominated all of East Africa. A warrior capable today of taking singlehanded and without benefit of shield, a charging lion on his spear, is not easily convinced of the white man's superiority!

Nairobi is no longer the small peaceful town of twenty-odd years ago, when the roar of near-by lions shattered the midnight stillness of this reviewer's expedition base in Parklands where doors were never locked. Today among the "city's" 14,000 whites, 40,000 Indians, and 55,000 Africans on location, an "additional 22,000 African thieves and thugs, sleeping in warehouses, motor lorry bodies, etc. are an ugly problem."

Changed far less are the tribes of the Northern Frontier Province. The nomad Samburu still herd their flocks among giraffe, oryx, zebra, and gerenuk from shrinking rivers (wasted by farmers at the headwater) to water pans. Boran and Somali bring their camel caravans into Marsabit, the "Paradise Lake" of the Johnsons. There Farsen saw the foundation stones of the Johnson house, once belonging to the dwelling of G. F. Archer, the first white man to build at Marsabit, and the lake only a mud hole with storks digging for frogs. But elephant and greater koodoo still inhabit the cool uplands. Everywhere water is now drawn for man and beast from 70-foot ancient wells.

Farson pays high tribute to Gerald Reece, Provincial Commissioners of this heat-blasted region, and to the conserva-



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tionists, Captains Archie Ritchie and Keith Caldwell, long-time wardens of the East African game and friends of countless Americans.

There is splendid description and thought-provoking fact in *Last Chance in Africa.* Anyone who knows this magic land will read Farson's book with appreciation and nostalgia and will be impressed by his effort to estimate correctly the complex relationship between the white man and the African in Kenya.

Mary L. Jobe Akeley

THE REASONABLE LIFE

- - - - - - - - by Clifford Gessler

The John Day Co., $2.75, 214 pp.

THIRTEEN years ago Mr. Gessler published a charming account of his life on a remote Polynesian atoll in a book called *The Road My Body Goes.* From this same experience with native life he has now culled out another sheaf of recollections; this one, however, selected to illustrate the cultural factors producing "the reasonable life" led by the Napukans and designed to serve as an object lesson to the harassed, troubled, and neurotic members of our society. He describes in well-chosen examples of native behavior under various circumstances how the Napukans resolve their difficulties and manage their affairs. A clear-cut philosophy emerges from these anecdotes and recollections, and the reader is led to contrast the easy adjustment of the Polynesian to the exigencies of existence with the tenseness and maladjustment too frequently found among ourselves.

Mr. Gessler's sympathy with Polynesian life is profoundly evident, and his insight into its motivation is often remarkably acute. These give his book a warm and moving spirit that cannot help being ingratiating to the reader. This alone is enough to make the reading of *The Reasonable Life* a worth-while experience in plumbing a strange culture, even though Mr. Gessler's philosophical asides and value judgments may not be completely acceptable.

Harry L. Shapiro

FISHING THE ATLANTIC

- - - - - by S. Kip Farrington, Jr.

Coward-McCann, $6.75
312 pp., 131 illusts.

IN *Fishing the Atlantic,* the author has produced a book that should be "required reading" for everyone interested in salt-water sports fishing. It is the work of an angling expert who also is a fine writer. The style is free-flowing and a considerable improvement over the author's previous books. The introduction, by Philip Wylie, is a masterly but deserved tribute to the writer.

Fishing the Atlantic is a most interesting and authoritative book on marine sports fishing which carries the reader smoothly from Nova Scotia down along the Atlantic coast in easy and informative stages to Florida, thence around the coast of the Gulf of Mexico to Alabama, Texas, and Mexico. There are chapters on Cuban fishing, Panama, Columbia, and Venezuela, on Bermuda and Jamaica, the Bahama Islands, Sweden, Denmark, France, and South Africa.

The book is profusely illustrated with reproductions of interesting photographs, and throughout the book the author imparts to the reader important information on boats, fishing accommodations, fishing methods, fishing tackle, baits, and lures. Every famous and near-famous angling area, offshore and on, is covered thoroughly so far as sports fishing is concerned, and every species of game fish for which these places are noted is described and commented upon in language every salt-water angler can understand.

Erl Roman

THE ADVENTURES OF MARCO POLO

- - - - Edited by Richard J. Walsh

The John Day Co.,
202 pp., 68 illusts.

IN the thirteenth century the Western world was slowly awakening from the Dark Ages. Ignorance of the Orient was so total that no one in Europe believed Marco Polo when he told the story of his travels throughout Asia. He had lived many years in China, during the short period of the Tartar domination. Marco, after his father and his uncle, had been a favorite of the Grand Khan Kublai, the great Mongol Emperor. In an official capacity, he had visited many strange countries. After his return to his native Venice, he was captured in war and jailed in Genoa, where he dictated the tale of his adventures. They sounded fantastic. Yet his account is certainly true in its essence.

Today, after many years of penetration and study of Asia, Marco's story can be better appreciated. Historians and geographers, of course, are particularly interested in his descriptions, but naturalists also find much to be learned from them. He never fails to mention the animals that he finds on his way. It is not always easy to identify them, and the accuracy of some of his statements may be questioned, as he often reports on hearsay. His accounts, however, teach us a great deal about the Asiatic fauna of his day. We are struck by the evidence of the tremendous and senseless destruction since caused by man. In Kublai's empire, game was preserved for the selfish enjoyment of the ruler and his deputies, but nevertheless adequately protected, while falconry, hunting, and animal training had attained an unbelievable level of efficiency.

For those who, like the reviewer, have long traveled in Asia in complete safety and comparative comfort, Marco Polo's adventures, with all their slowness of transportation, dangers, and hardships of many kinds, take a special significance and win deep admiration. They also bring home the terrifying notion that, in our very days, Asia has suddenly become closed to Western man even more tightly than it was in the Middle Ages.

R. J. Walsh's adaptation makes the Adventures easy, pleasant reading, and C. Le R. Baldbridge's illustrations are evocative and beautiful. It is all the work of men who know and understand Asia.

J. D.

THE WAY TO GAME ABUNDANCE

- - - - - by Wallace Byron Grange

Charles Scribner's Sons, $6.00
365 pp.

THIS book is a manual of the causes of fluctuations in game populations and the practices to be adopted if the wide swings from peak to crash in these cycles are to be avoided.

Cycles in the abundance of animal life are too well established to be open to question. But there is plenty of argument as to what the fundamental causes may be. There is a periodicity to these rhythms which suggests a possible, perhaps a probable, relationship to sunspot cycles. The subject is an intriguing and important one because the forces at work on game may very well have a profound, although not so direct and obvious, influence upon human populations and man's behavior.

The author develops his thesis in an orderly manner, beginning with an analysis of the environmental background and proceeding to a discussion of plant and animal successions and the results of habitat changes. He then discusses the response of animal life to alteration of the plant environment, the nature of game cycles, and finally suggestions for the control of these cycles.

Many examples are given to demonstrate the various principles described. These are generally convincing and well chosen. Good half-tone illustrations also help to establish the thesis of the book. "The cycle, in truth, proves to be *the pattern of life* for earth's creatures.

"Climate and plants are its two great dominating forces—both terrestrial expressions of the fluctuant stars and heavens."

It is not possible within the limitations of this brief review to attempt comment on the author's philosophy. The subject is complex and has its moot aspects. Grange has, in my opinion, given a very plausible explanation both of the visible features of cycles and the invisible forces that cause them. His book is an important contribution to the literature on cycles and will be a valuable reference in the library of any nature lover.

HAROLD E. ANTHONY

A ROMAN BOOK ON PRECIOUS STONES

- - - - - - - - - by Sydney H. Ball

Gemological Institute of America,
Los Angeles, Calif., $6.50
338 pp.

THE jeweler of today would be very happy to have gems now occupy the place in business and social prestige that they filled in Pliny's day. The best English translation of Pliny's famous book, that of Philemon Holland published in 1601, has long since outlived its usefulness as a guide to the "Naturall Historie of the World" and is little read today. Many will rejoice that Holland's old-fashioned phraseology has been simplified and clarified in this new gem book, assembled by Sidney Ball and edited by Kay Swindler.

The first third of the book presents a readable and fascinating picture of the source of gems, their uses, and their working in Pliny's day, the first century of our era. With numerous quotes from the Pliny text, it sums up the information imparted by Pliny in dribbles. The second third is a complete rewrite of Pliny's thirty-seventh book, printed on yellow paper to make it stand out and easy to locate. There are many marginal notes (infinitely preferable to footnotes, one might add) which give modern English equivalents for the gem names so far as Mr. Ball could determine them. The third section of the book is made up of notes on the numerous classic and historic references of the Pliny work. This section, too, is liberally embellished with marginal notes on the references to which Mr. Ball has gone for elucidation. A hasty glance will show that he read widely and to good purpose many authors seldom consulted today.

Sydney H. Ball was a very successful mining engineer, who was particularly well-known for his work in the African diamond deposits. His hobby was gems, particularly diamond data, and for years he wrote the gem section of the *Minerals Yearbook* of the U. S. Bureau of Mines. One may feel sure that the translations of Pliny's names, for which a degree of certainty has been indicated, are as close to the correct ones as we shall ever come. The editor, Miss Kay Swindler, deserves special commendation for the fine appearance of the book, the marginal notes, and the facsimile reproductions, as well as for the unusually extensive work with the text, which fell upon her as a result of Mr. Ball's death last spring. The publishers are also to be commended for their courage in printing such a fine but perhaps commercially venturesome book.

F. H. POUGH

CASTE, CLASS AND RACE

- - - - - by Oliver Cromwell Cox

Doubleday & Co., Inc., $7.50
624 pp.

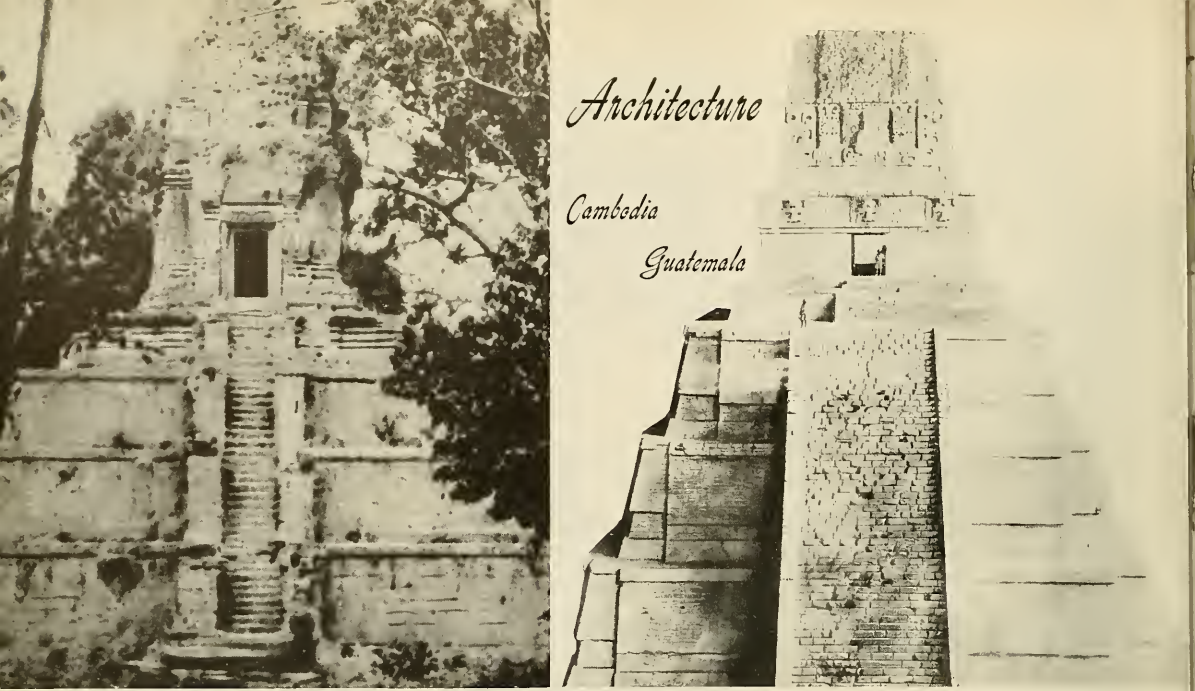
RACE conflict is one of the most disturbing problems facing the people of this country. Without a satisfactory solution to this unhappy situation, the tensions that mark race relations hover over us as a constant threat. They ramify throughout the social structure and decay its bonds. As long as we continue to ignore them, we weaken our moral strength as a people and endanger our leadership in the world.

Americans throughout their history have been aware of the dangers of racial stresses, particularly those latent in Negro-White relationships. There has never been a period from the founding of the Republic when the injustices of the Negro position in our society have not exercised some of our most thoughtful public men. And despite the outbreak of violence in the form of a civil war, which in part concerned the moral issues of slavery, the problem has persisted unresolved.

Mr. Cox in *Caste, Class and Race* has examined once again the position of the Negro in American society. He brings to the task a considerable apparatus of scholarship, a forthright and uncompromising intellectual position, and a vigor that demands attention. He rejects the assumption that the Negro has become frozen within a caste system and argues that his exploitation is rooted in the capitalist structure of American society. He is convinced that only by a socialist revolution will conditions prevail favorable to a final solution of this ancient and troublesome disharmony.

Despite the air of polemics that tinges the book, it has much to say that is worth considering carefully. And even if one cannot agree entirely with the author, he should be read, for he represents a point of view that has a number of supporters.

HARRY L. SHAPIRO



THE ALMOST identical form of these two temple pyramids from tenth-century Cambodia (*left*) and from the Maya culture of about the sixth century is indeed striking. Students who support the theory of cultural exchange between Asia and America point out similarities of detail, including the use of the corbelled vault, serpent balustrades, serpent columns, and attached columns in panels. Opponents of the theory point out the many differences in the architecture of southeastern Asia and Middle America

Is American Indian Culture

Most anthropologists believe that the high civilizations of Middle and South America developed without influence from abroad. A recent exhibit at the American Museum shows, however, why some scholars think there may have been traffic across the Pacific in the days before the Europeans discovered America

By GORDON F. EKHOLM

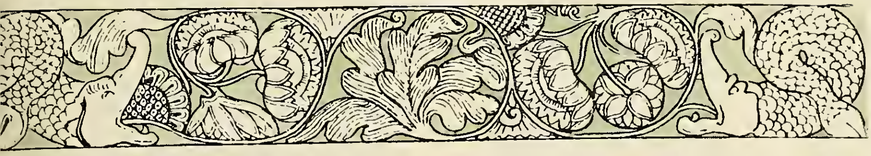
Associate Curator of Anthropology, American Museum of Natural History

DID the American Indian civilizations develop independently, or did they receive some inspiration or stimulation from the high cultures of the Old World? This is perhaps *the* most important question confronting those working in the field of American archaeology and seeking to make known the true history of the American Indian. It is also a question of outstanding significance to our general understanding of how civilizations come into being, of how simple and primitive cultures develop into more complex ones.

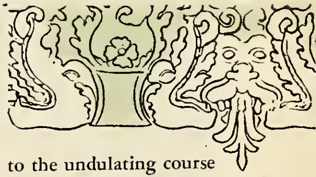
Anthropologists are in fair agreement that the New World populations—in a physical sense—belong to the Mongoloid racial stock and that they originally came out of Asia across the Bering Straits during or shortly after the last glacial period. We can imagine these early migrants and the other following groups pushing southward into warmer climates and gradually spreading out over the humanly empty areas of North and South America. They must have been

Decorative Motifs

Amarāvati. Southern India

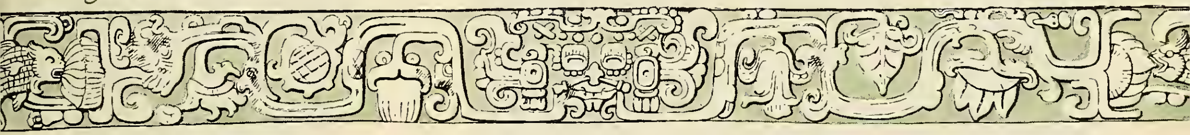


Ceylon

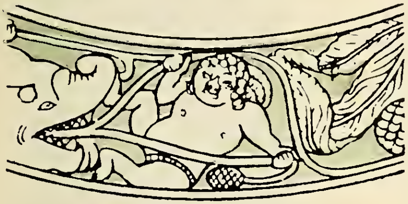


THE SCULPTURED PANELS above and below have enough elements in common to suggest historical relationship. The designs are based on the lotus plant, with the leaves and flowers accommodated to the undulating course taken by the stem of the plant. In both cases fish or fish-like creatures are placed at the ends of the patterns, and very similar jawless monster masks are used at the centers

Yucatán

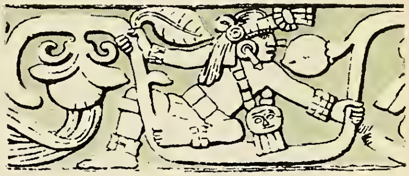


Amarāvati. Southern India



THESE PORTIONS of the same series of panels show human figures holding on to the stem of the lotus plant in a very similar way. Costumes and details are different, but the nearly identical arrangement of the figures strongly suggests a common tradition

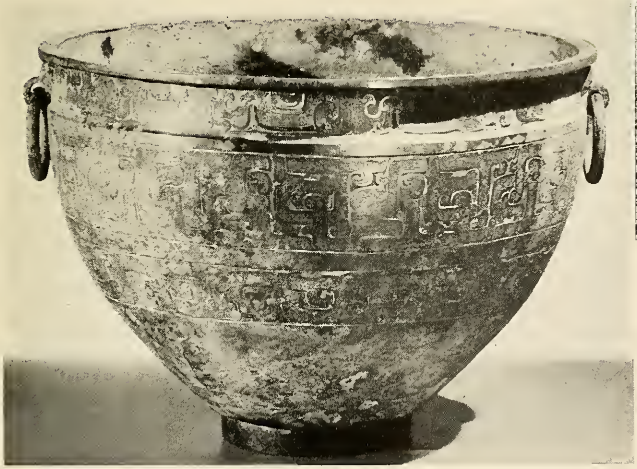
Yucatán



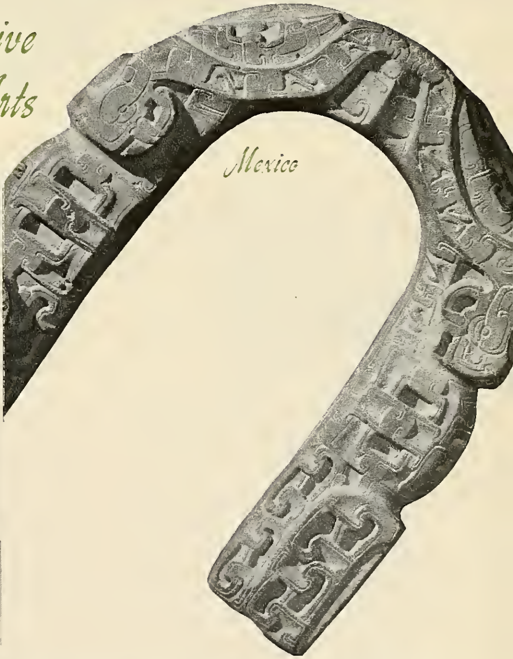
Asiatic?

Decorative Arts

China



Mexico



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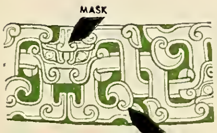
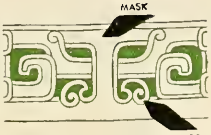
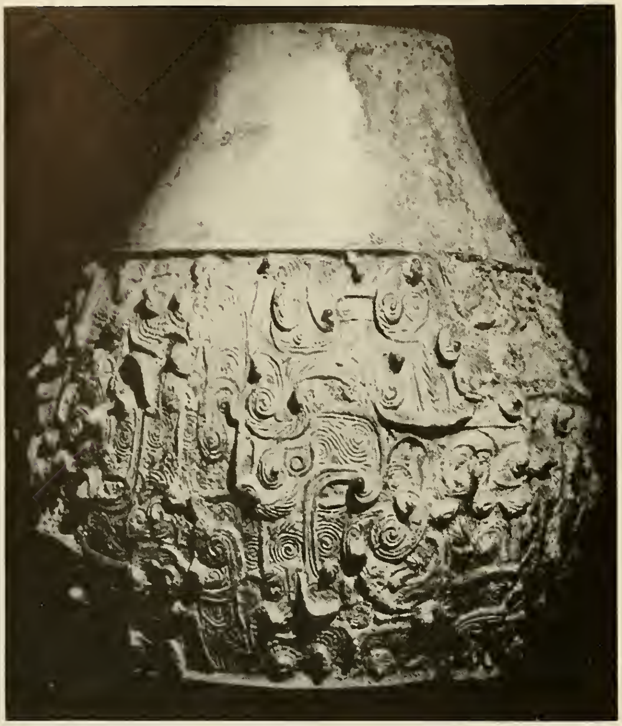
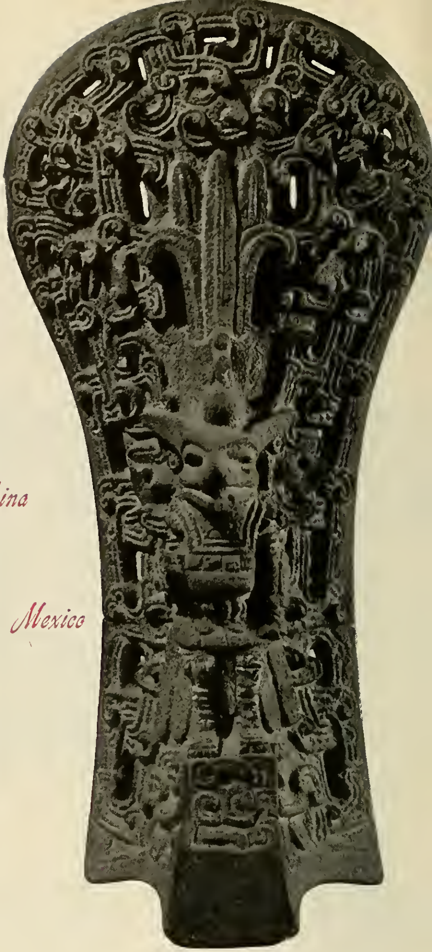


Mexico



STRIKING SIMILARITIES in design patterns are found in the Late Chou style of China and in the so-called Tajín style of Vera Cruz, Mexico. You will see in both a similar emphasis on interlaced bands in horizontal and vertical arrangement, with rounded corners. Masks or dragon-like figures are incorporated in both. Note also that both examples show the double outline and the identical use of what are known in Chinese art as dragon wings





This bronze vessel from ancient China and the so-called palmate stone from Mexico have the interlaced pattern mentioned before, but in a modified form. The whorls are more tightly wound, and they spiral out from the surface. Particularly the upper portion of the palmate stone shows this similarity

equipped with a simple hunting and gathering type of culture adapted to the subarctic climates of northeastern Asia and Alaska. This is a logical assumption, and it is supported by all the archaeological evidence of early man in the New World. Agriculture, which appears to be a basic necessity for a high civilization, could hardly have been brought to the New World by this route.

Assuming then, as it appears we must, that these early populations of North and South America were culturally quite simple, we must explain how they proceeded along the road toward civilization and ultimately produced such things as the magnificent Maya temples of Central America and the detailed and efficient governmental system maintained by the Inca in the Andean regions of South America.

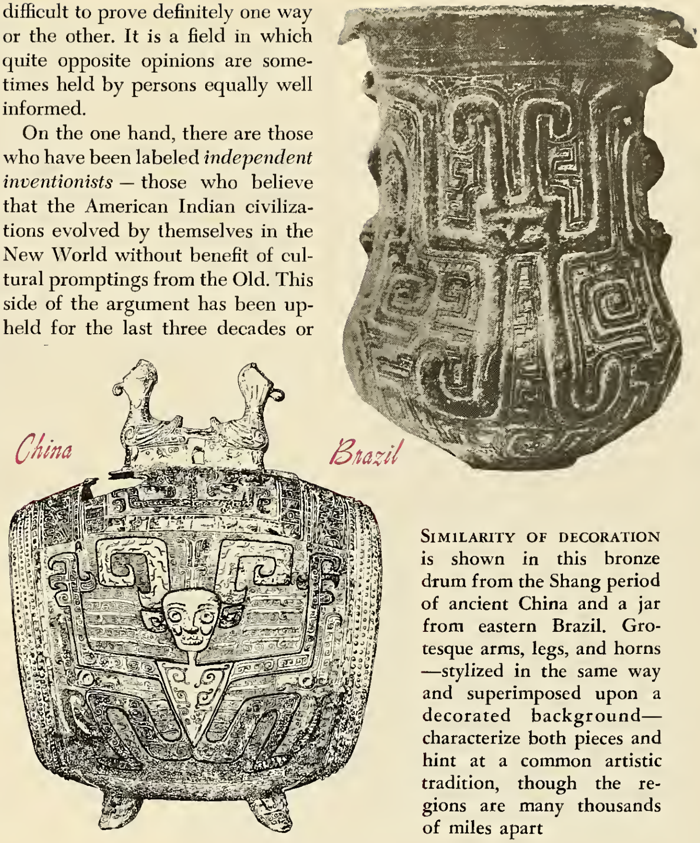
The importance of our questioning becomes more apparent if we examine the history of the early development of civilization in the Old World – in the Near East, Egypt, Europe, India, and China. The more we learn of these great cultural centers, the less it appears that they were separate civilizational developments. They all seem to have sprung from one cultural development occurring somewhere in the Near East, and their growth involved a certain amount of cultural interaction. Thus, despite their differences, they can be considered as one great cultural development.

Are the higher civilizations of America the world's only exception, the one other example of this all-important rise from a stage of primitive culture to the complex form known as civilization? If they are an exception, there have been two isolated occurrences of civilizational growth in the history of human culture, and we come as close as we ever will to having a kind of laboratory check on how civilizations, as great units of cultural development, originate and grow. This would obviously be of extreme importance to all theoretical considerations of human history. If, on the other hand, the birth of the American civilizations can be traced back to influences coming out of eastern Asia, it is something we must know if we are to evaluate correctly the history of human culture.

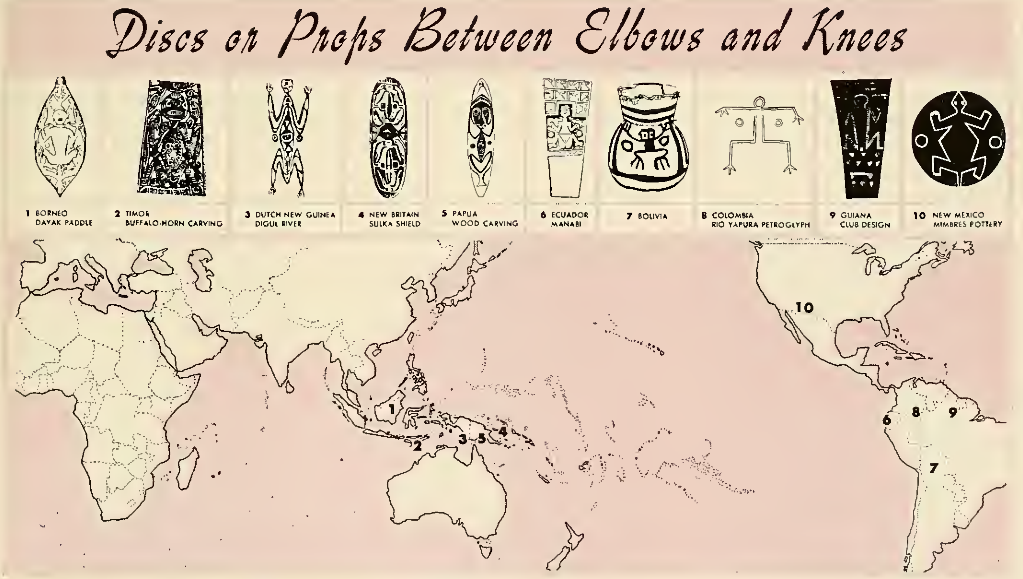
To phrase the question in more concrete terms: Are certain cultural forms inevitable in the growth of civilization? Given enough time, would any large group of people living in a suitable environment rise from a hunting-gathering existence to one based on agriculture? In both southeast Asia and the Amazon area, blowguns are used with poisoned darts for the hunting of small game, and they are remarkably similar in constructional details and in decoration. Was the blowgun invented independently in those two areas, because of the existence of similar environmental conditions and the presence of suitable materials? Is the form in which one makes a stone club so much governed by its intended use that such specialized types as the star-shaped or "pineapple" clubs found in Melanesia and America would be invented again and again?

This problem of whether or not the American Indian cultures were influenced by those of the Old World has been argued since the time when Europeans first came to know the American Indian in the fifteenth and sixteenth centuries. As we shall see later, it is a problem difficult to prove definitely one way or the other. It is a field in which quite opposite opinions are sometimes held by persons equally well informed.

On the one hand, there are those who have been labeled *independent inventionists* — those who believe that the American Indian civilizations evolved by themselves in the New World without benefit of cultural promptings from the Old. This side of the argument has been upheld for the last three decades or


China
Brazil

SIMILARITY OF DECORATION is shown in this bronze drum from the Shang period of ancient China and a jar from eastern Brazil. Grotesque arms, legs, and horns —stylized in the same way and superimposed upon a decorated background— characterize both pieces and hint at a common artistic tradition, though the regions are many thousands of miles apart


Discs on Props Between Elbows and Knees
1 BORNEO DAYAK PADDLE
2 TIMOR BUFFALO-HORN CARVING
3 DUTCH NEW GUINEA DIGUL RIVER
4 NEW BRITAIN SULKA SHIELD
5 PAPUA WOOD CARVING
6 ECUADOR MANABI
7 BOLIVIA
8 COLOMBIA RIO YAPURA PETROGLYPH
9 GUIANA CLUB DESIGN
10 NEW MEXICO MIMBRES POTTERY
1
2
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10

▼ ON BOTH SIDES of the Pacific discs or props are inserted between the elbows and the knees in conventionalized drawings of the human figure. The examples shown are a few out of the many that have been noted

From exhibit prepared by Dr. Carl Schuster

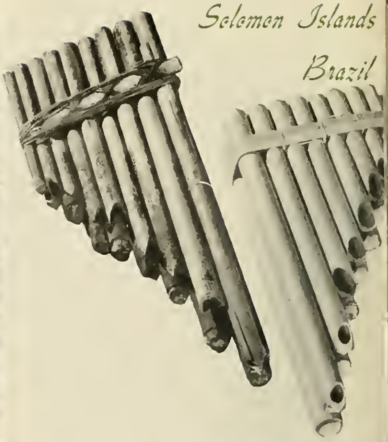
Music

Philippines

Dean C. Worcester
© Courtesy National Geographic Magazine

South America

NOSE FLUTES. The curious custom of blowing a specially made wind instrument with the nostril is found in the Philippines and South America. Being a trait common to simple cultures in the two areas, it might conceivably have spread from the Old to the New World with the original peopling of the Americas by the Bering Strait route. But students who are inclined to accept the theory of trans-Pacific traffic include this with the many other curious similarities



▲ PANPIPES provide one of the more convincing indications of trans-Pacific contact. They are found in Peru and many parts of the Old World. Pipes from as far apart as the Solomon Islands and Brazil have been found similar in pitch and scaling. Both of those shown have two rows of pipes, one closed and one open

more by a majority of the anthropologists working in the American field. The possibility that significant trans-Pacific contacts may have occurred has been almost totally discounted, and those who study anthropology in the United States are strongly indoctrinated with this point of view.

In contrast to those who would view the American civilizations as an independent growth are the so-called *diffusionists.* These would minimize the likelihood that the same things could have been invented more than once, and would explain the cultural parallels in the Western and Eastern Hemispheres as a result of historical contact. In recent years adherents to this point of view have not been numerous among professional anthropologists. Furthermore, among those who have espoused the cause and have thus flouted "authority," there are some who have seemed to find it necessary to take an extreme point of view, insisting that every cultural trait of any significance in the New World, if it appears similar in any degree to one in the Old, must have come by diffusion from the Old World. This has tended to weaken the argument rather than to strengthen it.

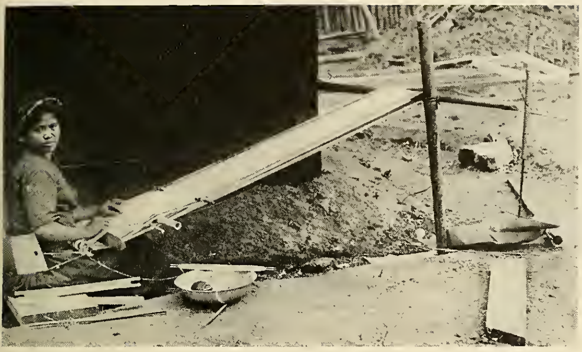
With an interest in bringing this problem more into the open and to stimulate serious discussion of it, the Department of Anthropology of the American Museum recently presented a special exhibit, which asked, in a visual manner, some significant questions about the possibility of Old World influences on the American Indian cultures. It was especially prepared for a meeting of the International Congress of Americanists being held at the Museum and was thus seen by an unusually large number of specialists concerned with the problems of American Indian origins. The interest shown by these experts and the lively debates that ensued were sufficient proof that our exhibit was dealing with an important problem.

The exhibit showed, side by side, objects and photographs of various things from Asia and Oceania on the one hand and America on the other, pointing out similarities that might be thought to indicate cultural relationships between the two areas. It asked the question: What do these parallels in the two areas mean? We do the same in a more limited way in the illustrations accompanying this article.

In attempting to trace historical relationships through the study of customs and material objects when no written records are available, some things must be considered more significant than others. It might reasonably be argued, for instance, that because of the limited number of possible ways that could be used to decorate woven textiles, the use of tie-dying might be invented again and again and its oc-

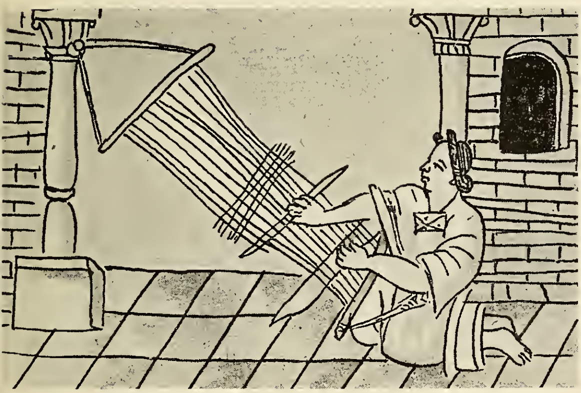
Textile Industry

Philippines



In both the Old and New World, the simple two-bar backstrap loom has several basic features in common, including the use of shed rods, heddles, and battens. Tie dyeing is common to southeast Asia and America, and so is the specialized decorative technique called *ikat*—a method wherein the yarn is dyed in such a way that a design will come out when the cloth is woven

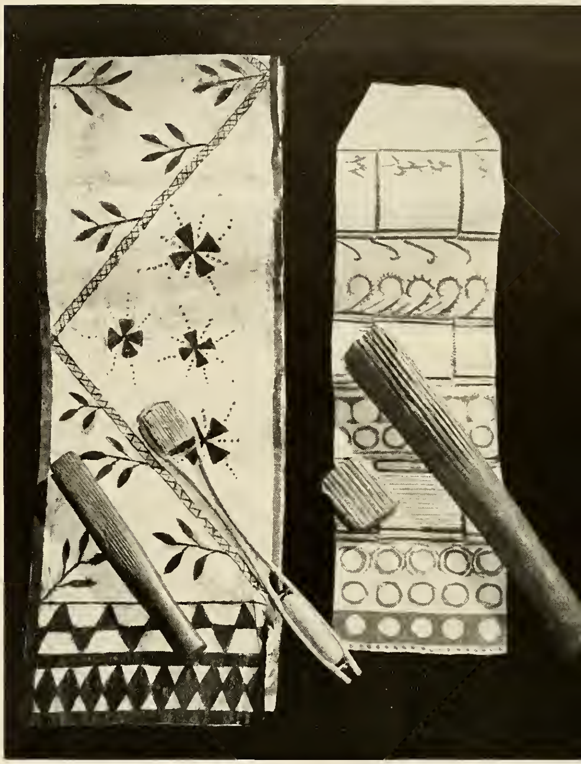
Mexico



Bark Cloth Manufacture

Oceania

Middle America

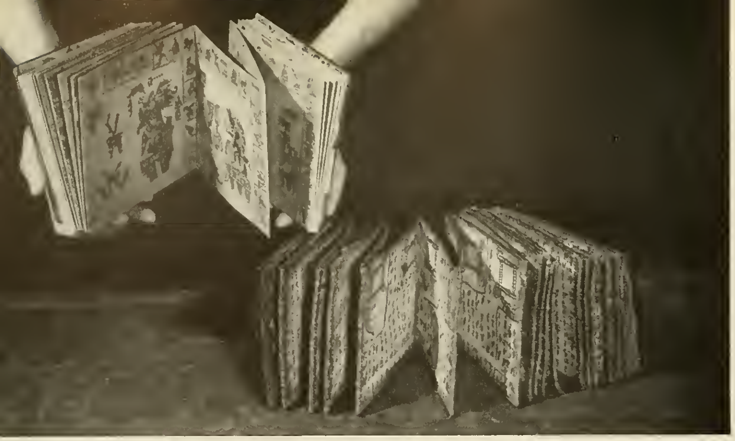


▲ The method of manufacture and the implements used are common to the Pacific area and tropical America. Outstandingly similar are the rectangular stone beaters from the Celebes and from Mexico, with corrugations on both sides and grooves around the edges for hafting. Are these identical tools and techniques the result of the same functional adaptations, or is historical relationship implied?

currence in two areas would not be an indication of historical relationship. But there is not the same limitation of possibility when it comes to decorative design. The possible combinations in naturalistic and geometric motifs make it exceedingly unlikely that the same combination will be invented repeatedly by groups having no contact. With this in mind, it is interesting to consider what we call the lotus motif as used in Buddhist art in India and southeast Asia and in certain Maya sculptures at Chichen Itzá in Yucatán. Because of a lack of space, full illustration of the comparable material cannot be given here, but the drawings we have included on page 345 may be sufficient to indicate some of the points of similarity.

In both areas the lotus plant has been used as the principal motif in the border portions of large relief-sculptured panels. In both cases the lotus plant has been given an undulating, creeper-like shape not corresponding to nature, and the buds, leaves, and full flowers are arranged within the pattern. Human figures are interspersed, holding on to the rhizome of the lotus plant in very much the same way, and fish or fishlike monsters are used at both ends of the panels. There are instances in both areas of the lotus emerging from the mouths of jawless monsters. Could this complex of motifs have been invented, or rather could it have evolved separately in the two areas without any contact between? To my mind it appears more probable that these similarities resulted from some historical contact between the two areas.

If these two occurrences of the lotus motif look sufficiently similar to stimulate one's interest in possible



Books

◄ SIMILAR METHODS of bookmaking are shown in these two examples from Mexico and Sumatra. They are made of a continuous strip of material, used on both sides and mounted between board covers. Both are made of specially prepared bark; both are, in part at least, books of divination

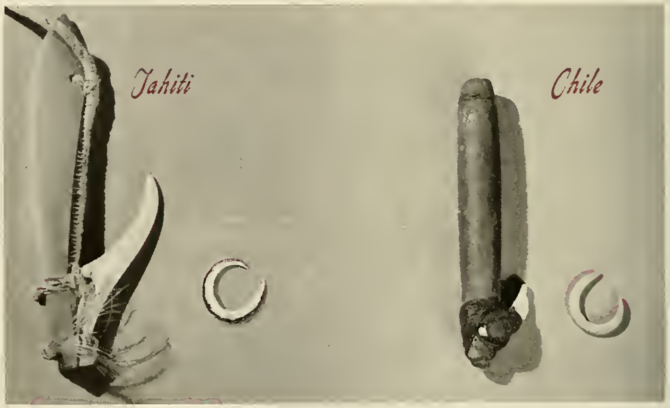
historical affiliations, let us look further for other similarities between the Buddhist art of India and southeast Asia and Maya art. In both areas a common religious-artistic conception portrays a dragon-like monster with wide-open jaws and with a human face or figure in the mouth. There is also the well-known "cross" at the Maya site of Palenque, having the form of a stylized tree with a grotesque face in its branches. This is markedly similar to the representation of the celestial tree on top of the cosmic mountain in the shadow-play figures of Java —a motif of considerable antiquity in southeast Asia. There are a number of other comparable motifs in the two areas, including the use of serpent balustrades, Atlantean figures, and gods or ceremonial figures standing on the backs of crouched

Implements

Easter
Island

California

THE DISTRIBUTION of certain forms of fishhooks provides striking evidence of possible communication across the broader reaches of the Pacific. These beautifully made stone fishhooks from Easter Island and California could hardly be more alike



▲ EVEN MORE SIGNIFICANT than the identical stone hooks are two other types found in combination on many islands of the Pacific and archaeologically in coastal Chile. In both regions, the larger composite hook is made of shell, bone, or stone, and the smaller one of shell

Wheeled Toys

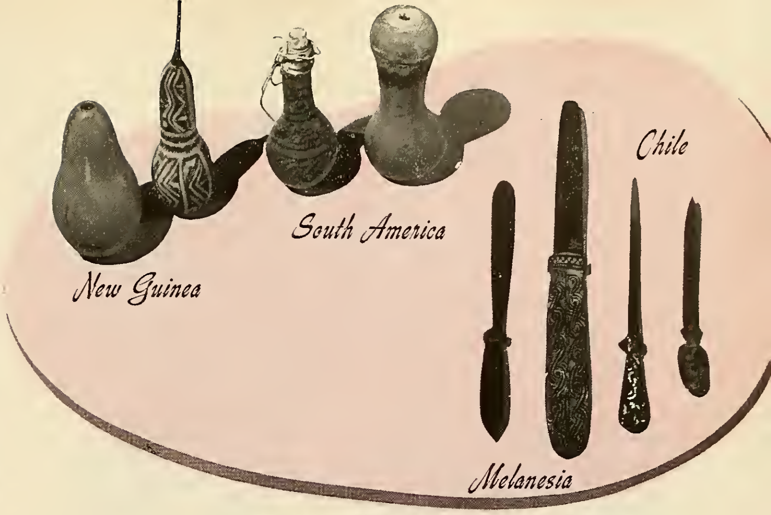
India

Mexico

THE FINDING of wheeled toys made of clay in Mexico (*right*) shows that the principle of the wheel was understood by the Mexican Indians before the time of Columbus, even though wheeled vehicles were apparently not used in transport in the New World. Similar miniatures in bronze, sometimes representing gods, were also used in China and India (*left*)

Betel and Coca

➤ BETEL-CHEWING in southeast Asia and Melanesia has much in common with coca-chewing in the Andean region. In both localities lime is added to release the alkaloid. Certain accessories used show remarkable parallels, as seen in this photograph. Lime containers in both regions are frequently made of gourds of the same species. Two wooden spatulae from Chile are very much like their Melanesian counterparts.



human figures. One of the most striking parallels, however, is that seen in the game of pachisi as played in India and southeast Asia and of the game of patolli as played by the Aztec. In these two games there are a number of quite specifically similar features that make it exceedingly unlikely that they developed independently.

The parallels we have mentioned so far are probably more significant than many of the others shown in the illustrations because they represent a complex of traits that belong to specific cultural traditions and specific periods in both Asia and America — the Buddhist dominated cultures of India and southeast Asia of from the second to the twelfth centuries and the Maya-Mexican cultures of the New World running from approximately A.D. 500 to 1200. In regard to these, we are not subject to the criticism often directed toward those who have attempted to link the Old and New World cultures—that scattered traits from here and there have been compared and no logical scheme of possible relationship has been given. In showing a number of similarities to exist between Buddhist art and Maya-Mexican art, we have outlined a specific area of study that can be attacked and discussed in a scientific way.

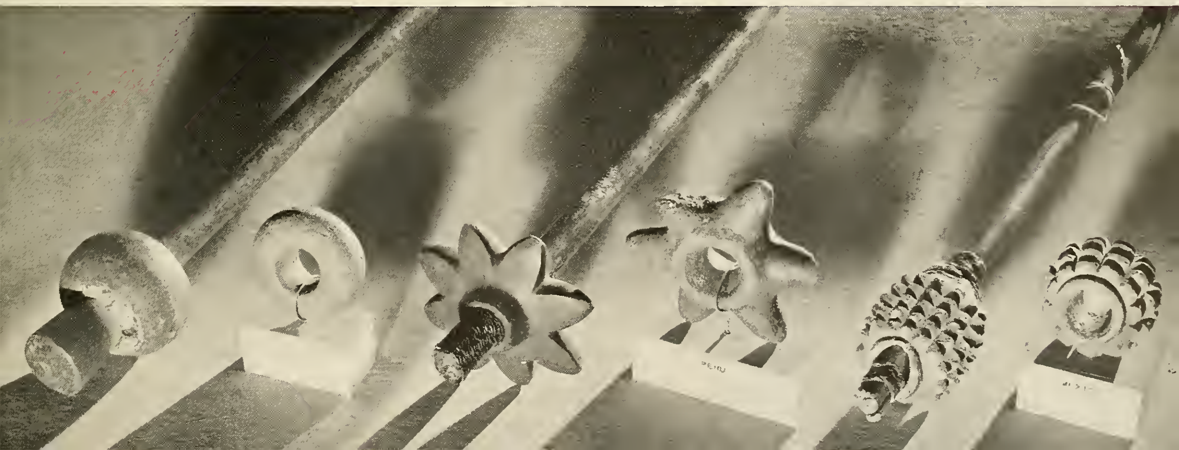
The whole problem of Old and New World relationships is, of course, so complex that we cannot begin to discuss it in any detail in a short article. We must mention, however, that recent studies of American cultivated plants have suggested the possibility that maize, or corn, the basic American food plant, may have been cultivated in upper India and Burma before the time of Columbus and transported in one direction or the other across the Pacific.

If we feel that these parallels between the civilizations of the Old and New Worlds indicate historical relationship, we find ourselves faced with the not inconsiderable problem of explaining how contacts between the two areas came about. What sort of contacts could have taken place across the very broad reaches of the Pacific? It is largely the difficulties involved in finding an answer

Continued on page 382

Weapons

⮟ STRIKING LIKENESSES are seen in the stone tools of Asia and Oceania on the one hand and the Americas on the other. The clubs with handles are from Melanesia, in the southwest Pacific; those without are from Peru and Mexico. Diffusionists argue that nearly identical forms like these could scarcely have evolved independently. Their opponents invoke the long arm of coincidence and point out the many *dis*similarities between the oriental and American Indian cultures

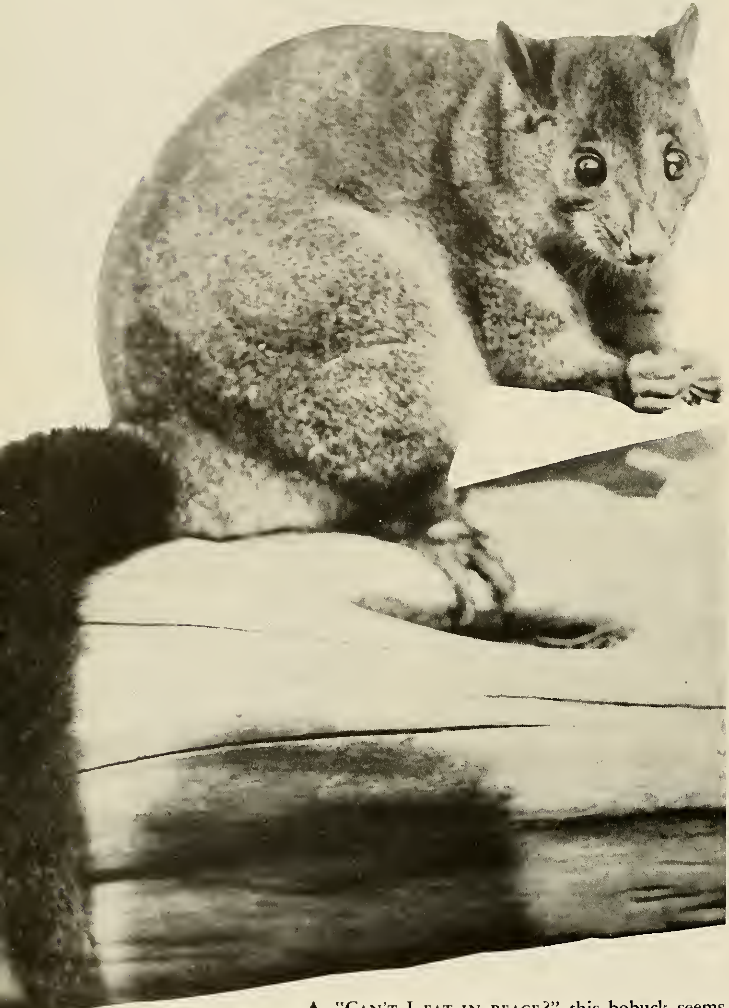


Meet Australia's bobuck—a rare and remarkable animal whose splendid pelt is its worst enemy

POSSUM of the HIGH RANGES

By David Fleay*

All photographs by the author



▲ "Can't I eat in peace?" this bobuck seems to remark as it strikes a characteristic pose. In its forepaws it holds a delicacy, which it chews happily despite the daylight

In the dense mountain timber fringing eastern Australia from south Queensland to southern Victoria lives the mainland's largest, most powerful, and finest possum. It is, in fact, the equal of the famous long-furred Tasmanian "Black." Usually referred to as the short-eared possum—an obvious distinction from the rather fox-faced silver-gray or brush-tail possum—this black-footed marsupial is also known by the aliases of mountain and dog-eared possum.

It is a remarkable, distinctive, and very alert animal, noted for a peculiarly rank and musky odor that is almost as easily detected in the bush as the powerful scent of fox. In the region of Gippsland in eastern Victoria this magnificently coated species (*Trichosurus caninus*) has the nickname of "bobuck"; and wearing the most prized of pelts it became, in open seasons, the trapper's most sought-after quarry. Sad to say, this striking marsupial took the brunt of destruction in the dreadful sweep of the 1939 bush fires, and only recently have I seen odd individuals in regrown areas that were formerly their strongholds.

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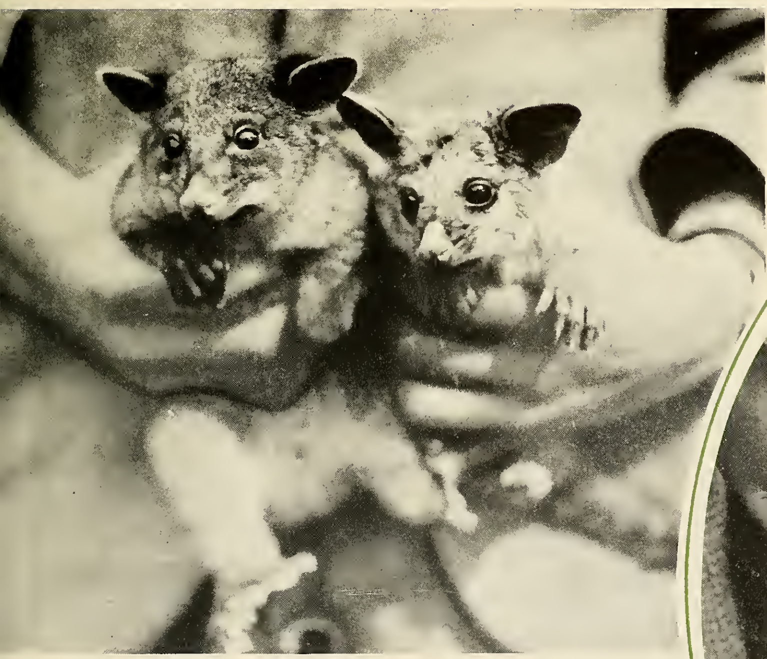
*David H. Fleay, an expert on the fauna of his native Australia, has approached his specialty from every angle: research, teaching, writing, and field work. He was the designer, builder, and curator of the Australian Section of the Melbourne Zoo and later director of the Sir Colin Mackenzie Fauna Sanctuary. In 1941, he was awarded the Australian Natural History Medallion.

Mr. Fleay is the only man who has succeeded in breeding the platypus in captivity; and it was he who captured, conditioned, and transported Cecil and Penelope, the platypus couple, to the New York Zoological Society in 1947. He is the author of two books, *We Breed the Platypus* and *Gliders of the Gum Trees*, and is a Council Member of the Royal Zoological and Acclimatization Society of Victoria. He has contributed to a number of periodicals.—Ed.

Typically a slow breeder and a creature of peculiar surroundings, this mammal has been unable to adapt itself to the great variety of foods and environments enjoyed by the common silver-gray (*T. vulpecula*). The bobuck is a mountain fellow and is essentially at home in the elevated, high-rainfall regions of mountain ash (*Eucalyptus regnans* and *E. gigantea*), beech, hazel, sassafras, dogwood, musk, and tree fern. This big possum, with its extremely bushy and almost wholly black tail, is usually dark gray in color. But from the scrubs of northern New South Wales and southern Queensland, a truly black race has been described, and odd velvety-black individuals have also revealed themselves in the Healesville-Warburton ranges.

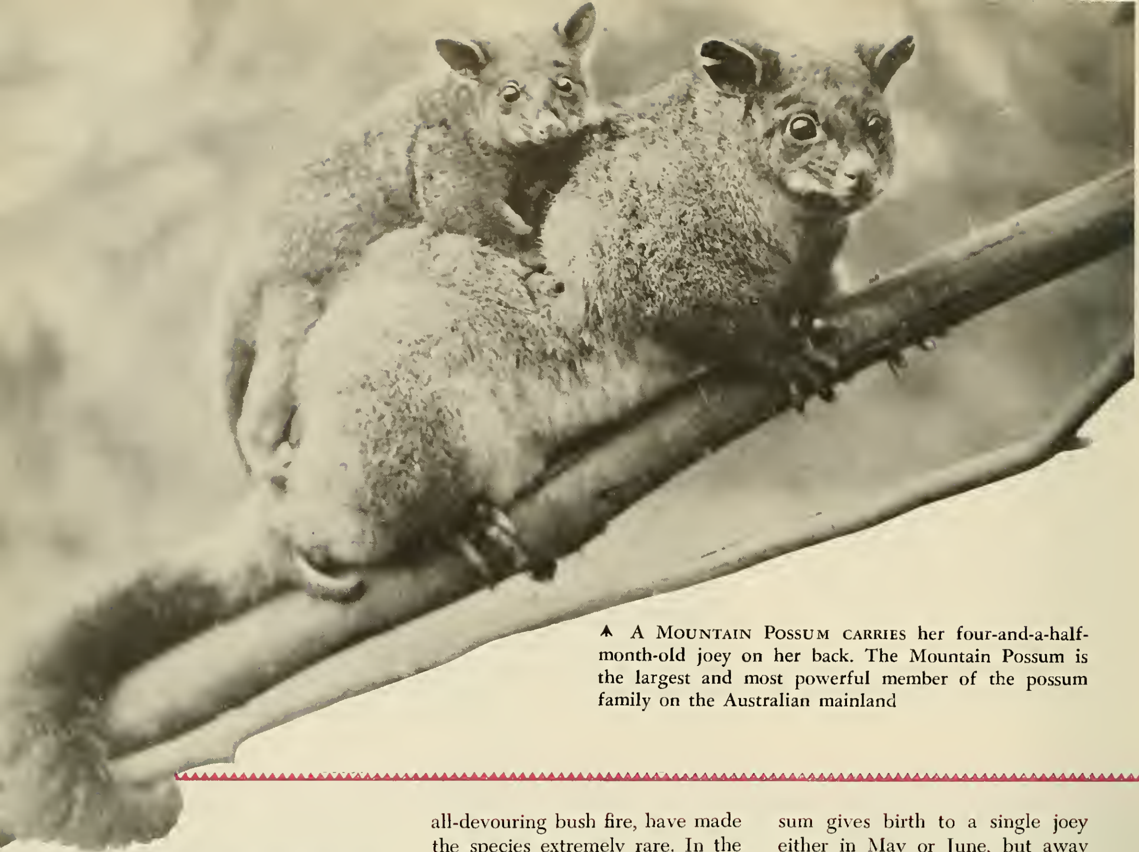
By night the big fellows wander the gullies, spending practically the whole of their time on the ground feeding upon succulent shoots and young leaves, fern fronds, flowers, and fruits. Following faint trails, they bound along handy bridgeways of huge fallen trees that span crushed and impenetrable masses of tangled vegetation. Seldom, indeed, does the bobuck ramble to a great extent in the trees, though it readily scampers aloft when danger threatens. The large sturdy feet are obviously more those of a ground wanderer than are the comparatively slender ones of its relative, the silver-gray. However, when actually treed by the sight or scent of intruders, the bobuck trumpets defiance in a series of loud and rapid staccato grunts that are quite unlike any other bush sound. Entirely distinct from the blare and chuckle of the silver-gray, this call is unmistakably characteristic of this species alone. At close quarters, the animals not only utter defiant grunts but raise themselves to full height with arms drawn back in sparring position ready to strike, at the same time adding "circular saw" screams for good measure. This is by no means pure bluff; incautious handling of the animal proves it a formidable antagonist, equally handy with its ripping claws and biting teeth. W. A. Wheelwright, the old bushman-author-game shooter of the 1850's, recorded very graphically the possum's habit of escaping the reach of an enemy, ". . . at which it will sit swearing after the manner of a cat."

In hours of darkness, the bobuck's forthright call may be heard occasionally from an enclosure in Healesville Sanctuary, where a fine eleven-pound specimen, originally bred there, now has a snug home in a hollow log. Recently, while spending some days and nights in the bush investigating lyrebirds, pleasant memories of other days were recalled when the insistent trumpeting of a wild bobuck in a near-by mountain ash proclaimed its dislike



▲ TWO JOEYS of different species: short-eared possum (*left*) and silvery-gray possum (*right*). Both are four and a half months old, but notice the difference in size

▼ A FOUR-WEEK-OLD POSSUM, naked and helpless, fumbles outside the mother's pouch. It is still strongly attached to the mammary gland. It does not become independent of the parent until it is six months old



▲ A MOUNTAIN POSSUM CARRIES her four-and-a-half-month-old joey on her back. The Mountain Possum is the largest and most powerful member of the possum family on the Australian mainland

of our hurricane lamplight. Sad memories were also recalled, for it was along the Acheron River in late 1938 that we undertook to capture the original mountain possums that graced the Sanctuary for so many years. Here Harry Kerslake and his wife and daughter watched the traps until success attended their efforts. When the great fire of '39 overwhelmed that beautiful valley and most of its fauna, it was the Kerslakes who so tragically perished in their ill-fated dash down the Acheron Way.

In past open seasons the mountain possum has been hunted unrelentingly for its thick and beautiful pelt. One of the natural baits used to attract the animals into snares and "figure-of-four" traps is a portion of the crown of a split tree-fern trunk—an irresistible delicacy to mountain possums. Unfortunately, the animal is not a rapid and hardy breeder, and in many mountain districts former trapping operations, plus the ravages of the all-devouring bush fire, have made the species extremely rare. In the event of a declaration of open season for possums in the future, it is earnestly to be hoped that the short-eared species will remain totally protected.

Though retiring and nervous in disposition, the bobuck has an appetite for delicacies that soon conquers its timidity. One night in a gully in the Dandenong Ranges the crackling of sticks among the damp tangle of blanket wood, sassafras, wattle, and hazel betrayed the movements of one of these big possums. I trailed it, but it suspiciously ran up a sapling and perched on a limb about seven feet from the ground. Leaping up, I seized the tip of its great bushy tail and brought the animal down. The bush rang with its ear-splitting shrieks; but less than four minutes later the same disheveled marsupial was squatting in a box, still snorting defiance but at the same time devouring a ripe pear with great relish and noisy chewing.

In Victoria the short-eared possum gives birth to a single joey either in May or June, but away from native foods it is not easy to induce the species to breed in captivity. The pouch of the female contains two mammae, but unlike the silver-gray, which occasionally rears twins, there are no records of more than a single youngster occupying the pouch at a time. Before the birth, the female constantly examines and licks out her pouch, and as soon as her pink, ugly mite arrives (only three-eighths of an inch long at birth!), it instinctively works its way into the pouch. In the case of the silver-gray possum, I have taken newborn young out of the pouch and have watched them re-perform this wonderful feat.

At birth the infant is not only minute but blind, with stunted, undeveloped limbs. For six weeks, it is firmly attached in the pouch, gradually developing power to move its own small jaws. It is most interesting to watch the mother's antics at night, as she pauses in her ambling walks to sit up on her haunches, relax the muscular, ring-like pouch-opening, and, holding it agape with handlike forepaws, thoroughly cleanse the small occupant with her tongue. At the age of about ten weeks, short fur appears first on the head and with time gradually spreads to the shoulders and lower body. At four months the young one, now about guinea-pig size, forsakes the pouch and rides at night on its mother's back, clinging tenaciously with claws and teeth. For some weeks longer, it continues to draw nourishment from within the pouch but also chews tender shoots that come within its reach.

If separated from its mother for even the briefest time, the joey soon attracts her attention with an urgent series of quavering, husky cries. "Roger," a baby mountain possum born and reared in my collection, usually rode on Ma's back to the food basin in the evening but always conveniently slid over her head to the honey, jam, and bread when she reached her destination. Not until it is six months old does the short-eared possum become independent of its faithful parent.

Present on the chest of mountain possums, as on the silver-gray, is a longitudinal streak of rust-colored fur in the otherwise creamy-white "vest." This is a glandular area; and, remarkable to relate, massage of the chest of one species of kangaroo has been known to produce a reddish pigment. Mountain possums, however, are in the habit of rubbing this area on convenient boughs, performing quite a ritual in the process. The next short-eared fellow to come along scents the spot, and with the obvious attitude of "So-and-So has passed this way," he, too, rubs his chest on the limb or bough. So much for self-expression among the nocturnal denizens of the big timber!

Though home trees of the species may usually be detected by the deep scoring of the bark, torn from the ground up by constant passage of strong claws, the animals do not always sleep aloft. They frequently camp in cavities created by termites and by rot inside great fallen logs. No attempt is made to line the resting place with materials of any kind; the animal simply squats, rolled up, on the bare wood. The musky odor, particularly strong in the "old men," is usually sufficient to determine whether the tenant of a hollow is at home.

▲ SETTING A SNARE in a deep tree-fern gully in mountain-possum country. The tree ferns range from one to forty feet in height. At this spot a stream dives twenty feet below the surface and emerges farther down. The bobuck thrives only in elevated, forest regions such as this

Spring, summer, autumn, and cold winter sojourns in mountain country on the trail of rare marsupials have brought us a variety of contacts, accidental and otherwise, with short-eared possums. Far up the slopes of Mt. Wills, northeastern Victoria, a trumpeting overhead awakened us at 2 A. M. one black night, and the spotlight beam revealed the blazing red orbs of a huge, thick-furred fellow perched on a thin sapling. Two strokes of the ax and he was down in a wild scatter of provisions and equipment. The ensuing chase flashed through and around camp, up and down blanket wood and dogwood bushes, until eventually "possie," minus patches of easily lost fur, was escorted back under guard, as breathless (though not as cheerful) as the gang that celebrated by "putting the billy on." I have met and carried several bobucks for miles out of the bush at Upper Beaconsfield, Bendock, Mt. Cole, Bonang, Korweingeboora, the Snowy River country, and nearer home at Healesville. I recall mountain possum in the brightness of morning daylight gazing reproachfully at us as they sat tethered in snares set for other game.

Perhaps the greatest anticlimax to an otherwise easy capture occurred on the Black Spur roadside one midnight in the 1930's. A bobuck had scampered off the road and bolted up a young ash; and as I followed, weakening fast and mighty breathless, up the branchless 20-foot trunk, that usually very thoughtful lady, my wife, suddenly emerged from the car shrieking, "Not in those good trousers!" Laughter was fatal, and I fell down helpless. What a time to tackle a man about the relatively unimportant subject of clothes!

A five-year-old boy was murdered on March 27 in Sarasota, Florida. Perhaps "murder" is not the right word, for Edward Schooley was killed by a circus elephant. "Dolly" had been one of the most docile members of the Ringling Brothers, Barnum and Bailey elephant herd for more than twenty years. But for some inexplicable reason she suddenly turned vicious and trampled to death the child who was offering her a peanut. The president of the circus publicly announced that Dolly would be destroyed, and this was done within three days after the tragedy.

According to radio reports, circus officials received many letters and telegrams from people all over the country complaining that Dolly's execution was unjustified. They apparently felt that a moral issue was involved and that an animal could not be held responsible for its actions. This point of view implies some interesting assumptions concerning animal psychology, but one thing is quite clear. If such an event had happened one or two centuries ago, the animal involved would have received quite different treatment. The law today states merely that dangerous or vicious animals must be destroyed. This represents a fairly recent simplification of older legal codes.

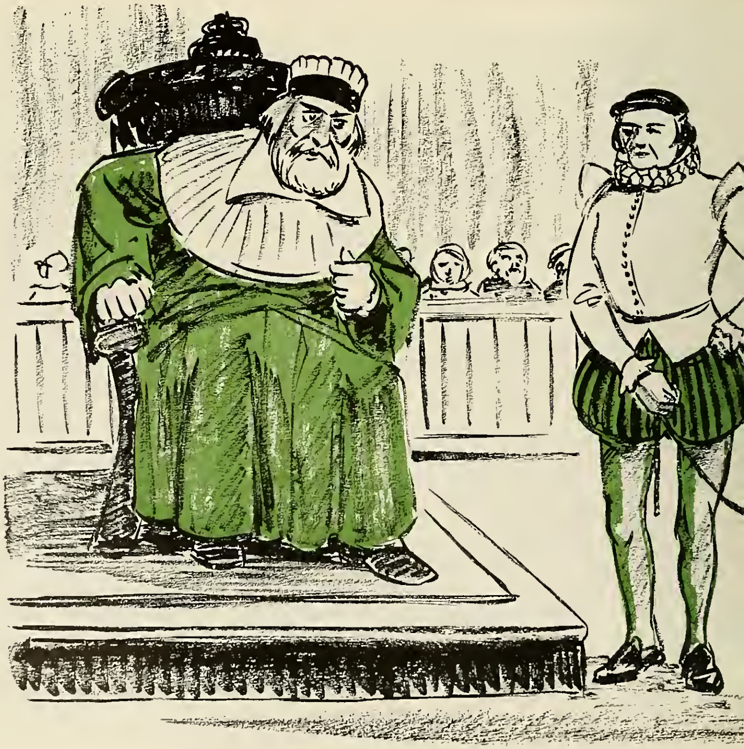
Ancient Hebraic law decreed that the goring ox be stoned to death. Plato's "Laws" directed that if any animal killed a man, except in combat authorized by the State, the nearest kinsman of the victim should prosecute the murderer. The case was tried by a public official, and if the verdict was against the accused, the guilty animal was banished from Greece. Citizens of Rome used to celebrate the anniversary of the preservation of the capitol from night attack by the Gauls. On this occasion homage was paid to descendants of the sacred geese whose cries had given warning of the enemy's approach. On the same day a dog was crucified for the failure of its forefathers to give the alarm.

During the Middle Ages the practice of trying and condemning animals was common in Europe and the British Isles and later even in the New World. It was not confined to small villages and backward regions. In 1546 the French Parliament, the highest court in the land, ordered the execution of a cow, which was first hanged and then burned at the stake. Similar legal trials survived until fairly recent times. In 1906 in a small Swiss village a man and his son, accompanied by their dog, robbed a householder, and in the course of the crime the victim was killed. The two men were sentenced to life terms; but the dog was condemned to death because, the court decreed, it was the chief culprit, without whose complicity the crime would have been impossible.

Between A.D. 824 and 1845, there were at least 144 formal prosecutions resulting in the execution or excommunication of animal criminals. When a domesticated animal injured or killed a human being, it was formally arrested and thrown into jail. Then the judge or ruling nobleman of the district appointed one or several attorneys, who were charged with the duty of defending the accused. Public prosecutors and defense lawyers argued each case before the bar, and the evidence was weighed carefully by the judge before he rendered his verdict.

Mass indictments were not uncommon. On September 5, 1379, the village swineherd of Saint-Marcelle-Jenssey left the communal herd in the care of his son. Before his father was out of sight, the boy began to tease some nursling piglets, which promptly burst into

Beasts



▼ **The highest French court** tried a cow in 1546. On the assumption that animals possessed a moral sense, capital punishment was the verdict a cacophony of terrified squeals. Three old sows charged the tormentor, knocked him to the ground, and killed him before his father could intervene. All the pigs were hurried off to jail, and after due process of law, Philip the Bold, Duke of Burgundy, condemned the three murderers to death. Their guilt was so plain that no one protested the decision, but the legal position of the remaining animals was less clear. The prosecutor insisted that they should be punished as accomplices. He called several witnesses, who testified that all of the swine had hastened to the scene of the murder and shown by their gruntings and aggressive actions that they thoroughly approved of the assault. A wholesale execution was narrowly averted when the attorney for the defense pointed out that the punishment of the convicted pigs would doubtless serve as an effective object-lesson to the other swine and would deter them from committing any more offenses against men. The Duke found this argument convincing; and when the three murderers went to the gallows, the rest received a severe warning and were then released.

It was commonly assumed that lower animals possess a moral sense and could reasonably be expected to understand and obey man-made laws. But there were some jurists who held that the animal's owner was at least partially responsible for its actions. On January 10, 1457, a sow was convicted of "murder flagrantly committed" and was sentenced to be hanged. Her six sucklings were originally included in the indictment as accomplices. Positive proof was lacking, however, and they were released to their owner after he had furnished bail for their reappearance in the event that new evidence was uncovered. The man apparently believed in the inheritance of criminal tendencies, because after worrying about the matter for three weeks, he brought the piglets back to court, openly repudiated them, and refused to be answerable for their conduct in the future.

Swine were not the only animals guilty of criminal offenses. Cattle and horses occasionally ran afoul of the law and received precisely the same treatment as human criminals. Not only was the court procedure the same in each type of case; the same methods of execution were employed. The more common forms of capital punishment were hanging, beheading, or burning at the stake. Whenever possible, the animals were dressed in human clothes before the sentence was carried out.

Homicide was not the only crime for which animals were tried and punished. Jail sentences ranging from a few weeks to several years were not uncommon in cases of the willful injury of a human being by dogs, horses, cows, or other animals. In one Russian village a "he-goat" butted an important official while he was fastening his shoe, and as punishment the goat was banished to Siberia.

A German innkeeper's dog showed such poor judgment as to bite the leg of a village councilman. The animal's master was jailed at once, but he complained so vigorously against this miscarriage of justice that the judge ordered his release. After all, the innkeeper argued, why should he languish behind bars while the real culprit went free? Appreciating the logic of this approach, the court arranged for the incarceration of the dog for a period of one year. The sentence was duly served, and the animal shared its cell with two human prisoners.

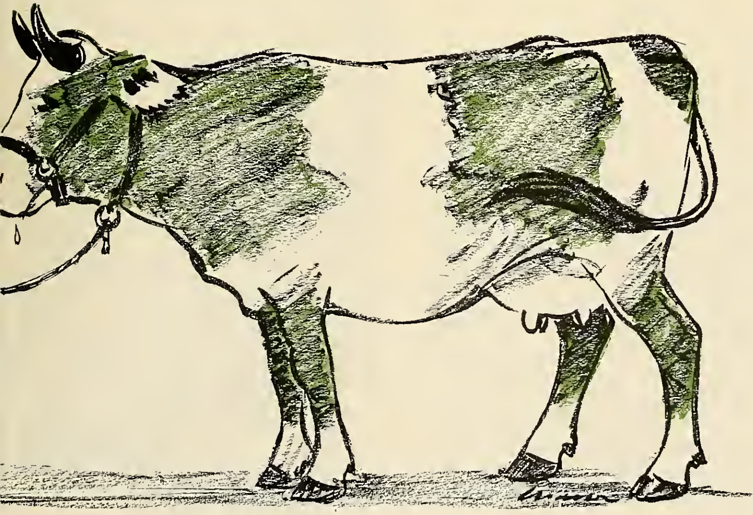
Medieval methods of dealing with *wild* animals were, of necessity, more complicated. It was often

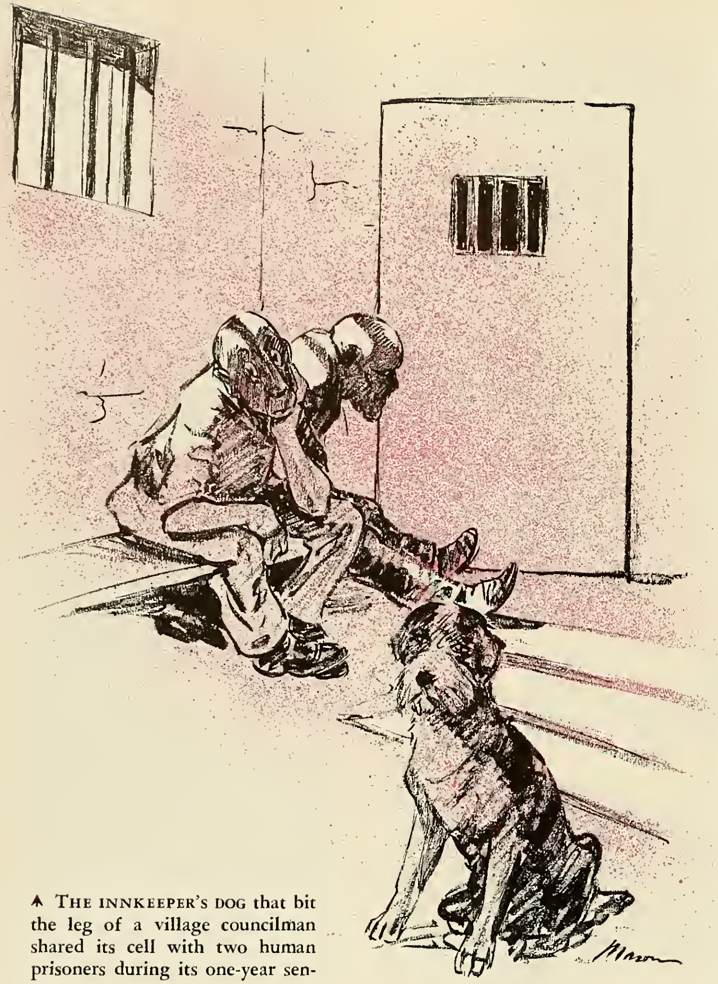
Before the Bar

Quaint court scenes of yesteryear show that ignorance of the law was once no excuse even for an animal

By Frank A. Beach

Department of Psychology,
Yale University





▲ **The innkeeper's dog** that bit the leg of a village councilman shared its cell with two human prisoners during its one-year sentence

impossible to capture and keep in jail the untamed creatures that sometimes brought harm to men. Nevertheless, the death sentence was occasionally imposed. In 864, the Council of Worms decreed death by suffocation to a swarm of wild bees that had stung a citizen to death. When animal culprits were not available for physical retribution, action of a different sort was possible. Insects and other pests that indirectly harmed a man by destroying his property could, with appropriate assistance from the clergy, be excommunicated. This extreme measure was not usually resorted to until milder alternatives had been exhausted.

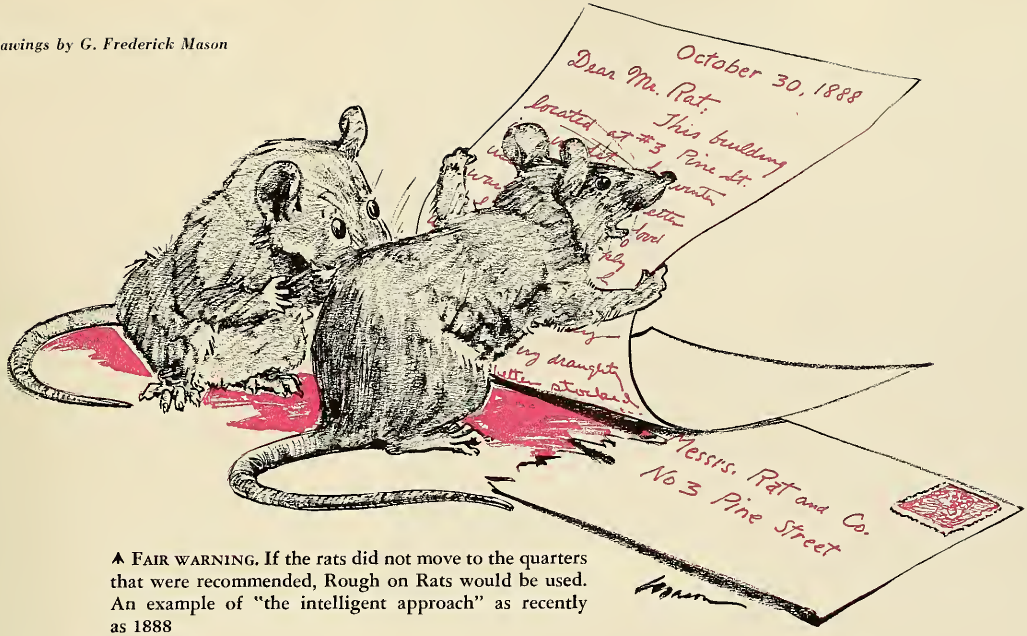
It was customary for example, to implore a swarm of locusts or a colony of rats to depart and cease whatever depredations they may have been committing. In some cases formal provisions for sanctuary were arranged, and the animals were notified by a Crier that they could take and maintain possession of a particular plot of land which had been set aside for their use. Usually the threat of excommunication was employed in an attempt to force the undesirable visitors to move away.

After the Middle Ages the Church grew less willing to participate in such animistic rituals as the excommunication of animals, but laymen continued to rely upon the efficacy of direct appeal to the presumed intellectual and emotional natures of lower animals. Sometimes the approach was informal and persuasive. In an old issue of the *Journal of American Folk Lore* there appears a copy of a letter dated October 30, 1888. It is addressed very correctly to "Messrs. Rat and Co." The writer begins with fervent expressions of his esteem for the rats and mentions his fear that they must find their present quarters at No. 3, Pine Street quite unsuitable for winter occupancy. He points out that the building was intended only as a summer residence and therefore is draughty and poorly supplied with food. By fortunate coincidence there is at No. 36, Sea Avenue a large, well-built house where the rats "can live snug and happy." The cellar is well stocked and a near-by barn contains large stores of grain. (Directions for reaching the address are included.) Having thus demonstrated his good intentions, the author of the published letter politely suggests that the rats take advantage of his well-meant advice. If they fail to do so, the letter concludes, "the undersigned, who owns the property at No. 3, Pine St., will be forced to use Rough on Rats."

The ethical propriety of adjuring the vermin to move to a neighbor's house seems not to have concerned this gentleman. At that, he was only

▼ **A provision** of the sentence was that the accomplices be warned of the punishment meted out to their more belligerent associates

Drawings by G. Frederick Mason



▲ **FAIR WARNING.** If the rats did not move to the quarters that were recommended, Rough on Rats would be used. An example of "the intelligent approach" as recently as 1888

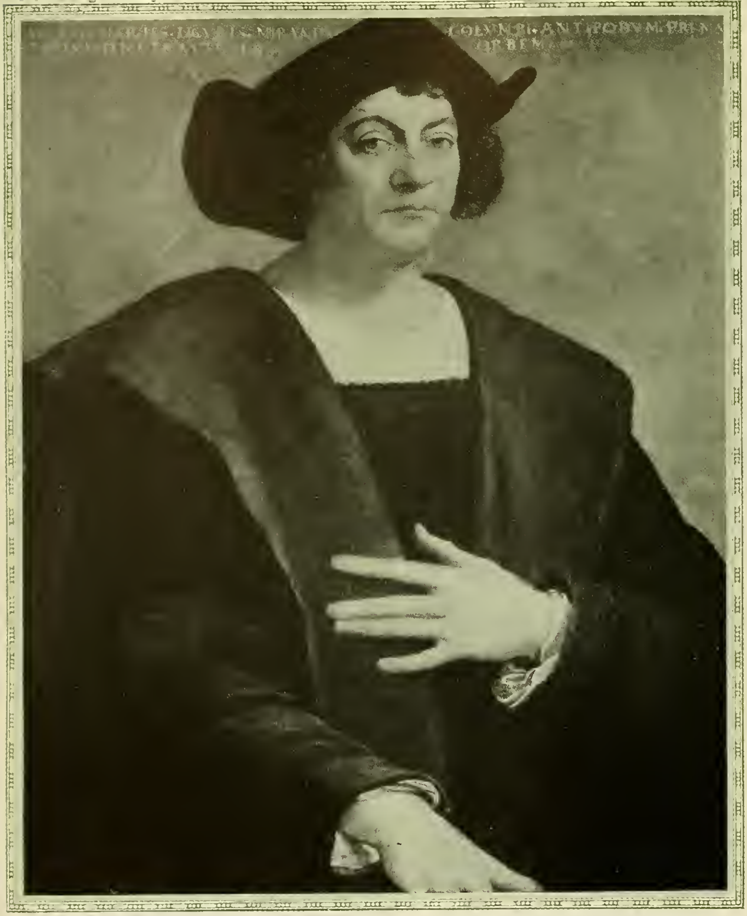
repeating, with minor modifications, the medieval offer of sanctuary. The more attractive the new abode, the better the chances of acceptance. Peasants in some parts of Europe followed a similar practice in attempting to get rid of cabbage worms. It was customary to go out into the garden and invite the worms to depart, calling out, "In yonder village is church-ale." Church-ale signified a festival which, the peasants must have assumed, no lively cabbage worm could possibly resist.

These historical accounts illustrate the universal human tendency to recognize certain similarities between ourselves and lower animals. In scientific jargon the tendency is termed anthropomorphism. It rests upon an implicit belief that other living creatures have the same kinds of psychological experiences as men and women. Probably many of the people who protested the killing of the circus elephant, Dolly, rationalized their objections by thinking of the precipitating event as an "accident." They may have felt that the animal did not "mean" to injure the boy. Regardless of their reasoning, these individuals were reacting precisely as human beings have reacted for many centuries.

Basic human attitudes and beliefs do not change rapidly. The notions that permitted our forefathers to try, convict, and execute animals as though they were criminals are not completely lacking from our own psychology in this modern and supposedly scientific age.

The difference is that our ancestors assumed that animals had a moral sense and that they either lived up to it or not. If an animal was guilty, it must be punished according to the same laws that applied to man. Today, we know a great deal more about the psychology of animals than our ancestors did and are in a position to know much better how a given animal should be treated. We should ask whether the offender is naturally vicious or whether it was goaded to violence by somebody's cruelty or carelessness.

The emphasis today is on proper precautions and laws to ensure public safety. Society demands that a dangerous animal be put where it can do no harm; but it also demands that the animal be treated humanely.



◂ THERE ARE many pictures of Columbus, but few seem to portray the same man. This one, in the Metropolitan Museum of Art, was painted by the contemporary artist Sebastian del Piombo

The Signs

On the 500th Anniversary of the birth of Columbus, a modern scientist retraces the momentous voyage and shows how much the famous navigator depended on his natural history information—and misinformation

By N. J. BERRILL

McGill University

COLUMBUS first saw the light of day 500 years ago, in the middle year of the fifteenth century.* Forty-two years later he saw another light, as strange and puzzling as the first. And because he himself was the first to see it, and because the landfall came only a few hours later, Columbus in person was credited with the actual sighting of land.

For days Columbus had been sailing on a westerly course that trended to the southwest, and expectation of a landfall was already running high. Late in the day of October 7 great numbers of birds were seen flying toward the southwest, and with the thought that they were going to sleep on land, Columbus changed his course from west to west-southwest. Land birds were seen all the next day, and birds were heard passing throughout the night of the ninth. Land seemed to be close, and hearts were uplifted. "Thanks be to God," said Columbus, "the air is very soft like April at Seville; and it is a pleasure to be here, so balmy are the breezes."

The "Nina," the fastest ship of the three, was already pushing forward, hoping to enjoy the handsome reward the Sovereigns had promised, and the Admiral had ordered that whoever should sight land first should hoist a flag at the masthead and fire a gun. At two hours after midnight on October 12, Rodrigo de Triano, a sailor on the "Pinta," saw the island in the moonlight.

This was the landfall, but what of the light? Columbus had been alone on the castle of the poop earlier that night, at ten o'clock—long after dusk and before the moon had risen. In the darkness of the night on the edge of the tropics, he saw a light and called to his companions. They saw it several times, and it was compared to a wax candle flame rising and falling. Columbus himself thought it was a sign of land, but no more than that; and decision that the light was actually on land—the decision that gave Columbus the award and later sent Rodrigo a disgusted renegade to Africa—was made virtually by default. No other explanation of the light was forthcoming.

The first sight of land was in the light of the moon and at a distance of six miles. Land as low-lying as these islands, seen from ships as small as the "Santa Maria," would seem to lie pretty well on the horizon at that distance and could hardly be seen much farther away. The light had been seen 4 hours earlier; and at the speed recorded at

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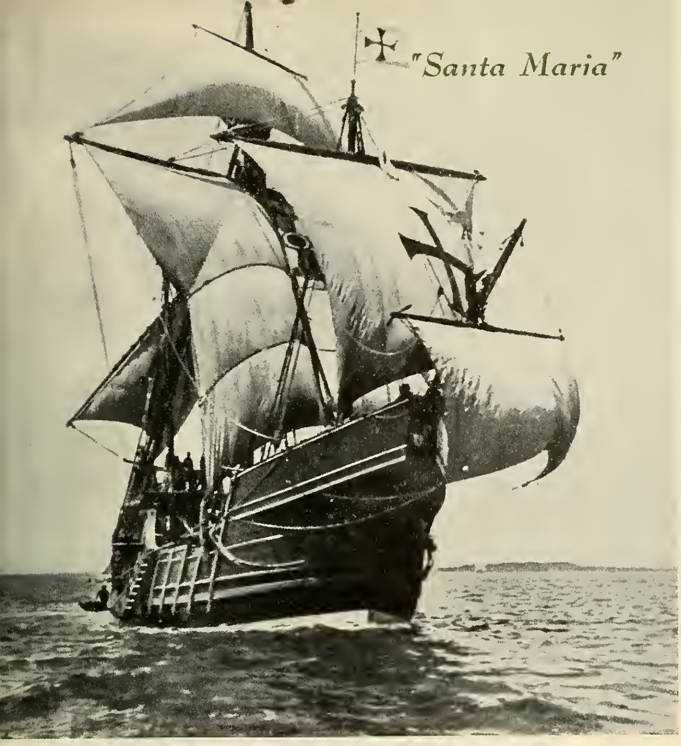
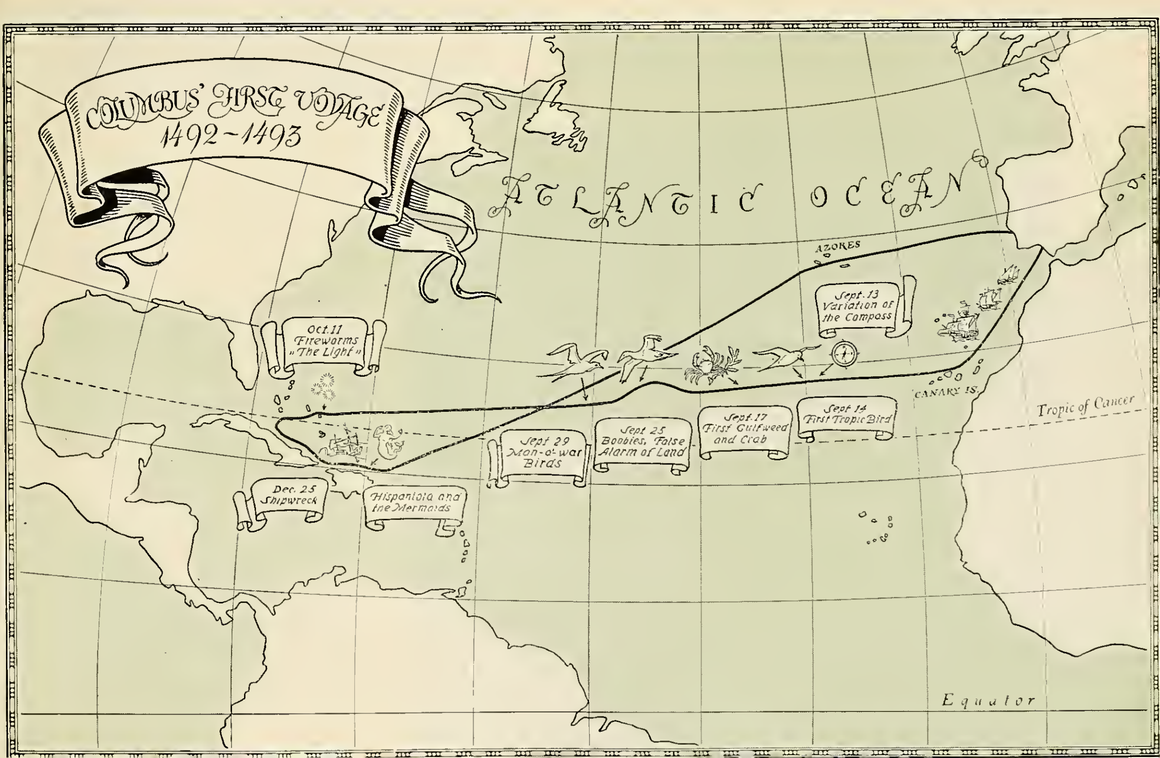
* Estimates range from 1446 to 1451.

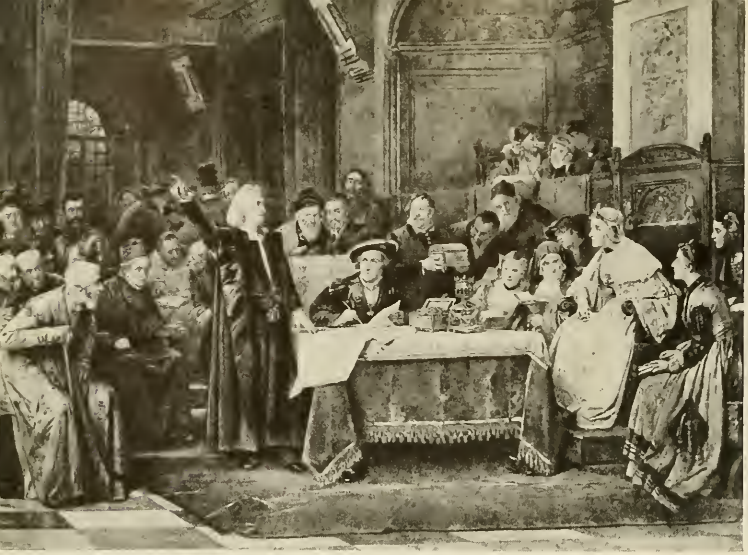

"Santa Maria"

Models of the three ships used by Columbus on his first voyage to the New World

from Brown Brothers

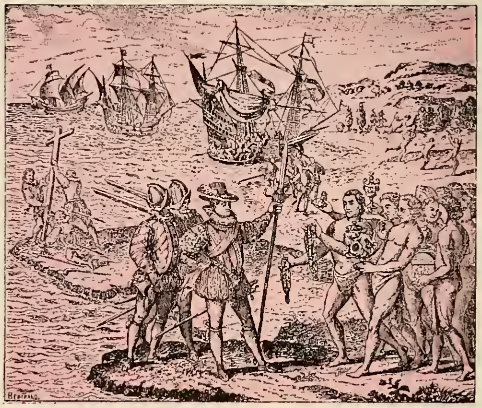
olumbus Followed


Columbus' First Voyage
1492~1493
Atlantic Ocean
Azores
Sept. 13 Variation of the Compass
Oct. 11 Fireworms "The Light"
Canary Is.
Tropic of Cancer
Sept 14 First Tropic Bird
Sept. 17 First Gulfweed and Crab
Sept 25 Boobies, False Alarm of Land
Sept 29 Man-o'-war Birds
Dec. 25 Shipwreck
Hispaniola and the Mermaids
Equator



From Ewing Galloway

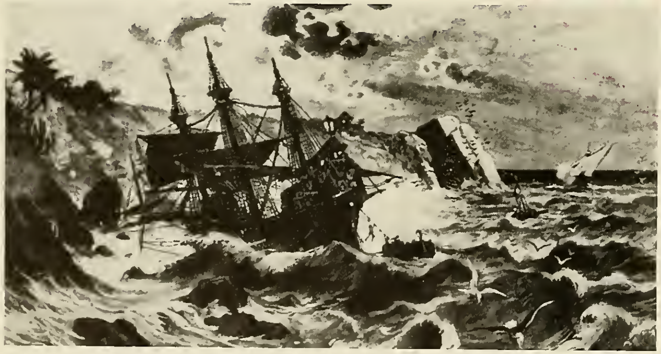
▲ A painting depicting Columbus before Queen Isabella, succeeding after years of effort to secure assistance for his voyage to China and the Indies. Neither dreamed that a whole new world would be discovered. Had Isabelle known he would not reach the Orient, his voyage might not have taken place



The Bettmann Archive

➤ An imaginative portrayal of Columbus' first landing in the New World. Natural history signs recorded by the explorer now indicate that this spot was on Cat Island rather than San Salvador

▼ The wreck of the caravel "Santa Maria" on the coast of Hispaniola on Christmas Day, 1492. Engraving after Adolph Closs



The Bettmann Archive

the time, 35 to 45 miles had been traversed in the interval. So the light could not have been on the island that became San Salvador.

The question of the light has worried many people. An unexplained mystery bothers a man like an unfinished sentence, and the simpler the facts, the more we look for an answer. Suggestions that it was a light in a native canoe or a product of pure imagination are hardly credible, for the canoe would have been dangerously far out in the Atlantic, and the record is too detailed to be one of hallucination.

In recent years another explanation has appeared that fits like the missing piece of a jigsaw puzzle. The answer, of all things, is worms!

A delicate little sea worm, one to two inches long, lives abundantly among the rocky reefs of the Bahamas. This is the fireworm, brightly luminous in the dark, and it regulates its habits according to the state of the moon.

When it is time to spawn, the worms leave their homes among the coral in shallow water and swim to the surface of the sea. The females shed their eggs with an intensely phosphorescent slime, shining with the same light that fireflies flash in summer evenings. Groups of worms arrive suddenly at a given spot at the surface, flash several times, and as suddenly disappear. If the watchers on the "Santa Maria" saw the flashing fireworms from a distance of 100 to 200 yards on a very dark night, they would undoubtedly have received the impression of a candle waxing and waning, and they could not have judged the distance. The fireworms could have produced the right kind of light. Could they have produced it at the right time?

The worms spawn every month, winter and summer, but they pick their own time. They rise only when the sun has long set and before the moon has risen. Before the moon is

From Ewing Galloway

▲ STATUE of Christopher Columbus at Trujillo, San Domingo, one of the islands the navigator touched on his first voyage. He was once buried in the cathedral in the background, but his remains now lie in Seville

full, it is in the sky earlier than sunset, and there is continuous light. The full moon rises as the sun sinks below the horizon, and not until several nights afterward, when the moon is approaching the third quarter, is there a fair interval of complete darkness between sunset and moonrise. And so, each month, commencing a couple of nights after full moon, the worms leave the island reefs on several consecutive nights to display their ethereal light at the surface of the sea until no eggs are left.

Columbus saw the light at 10 P.M., two hours or so after sunset, an hour before moonrise, as he wrote in his journal. There is little doubt that the fireworms were busy about their luminous duties at the time the light was seen. It is only reasonable to assume it was the same light.

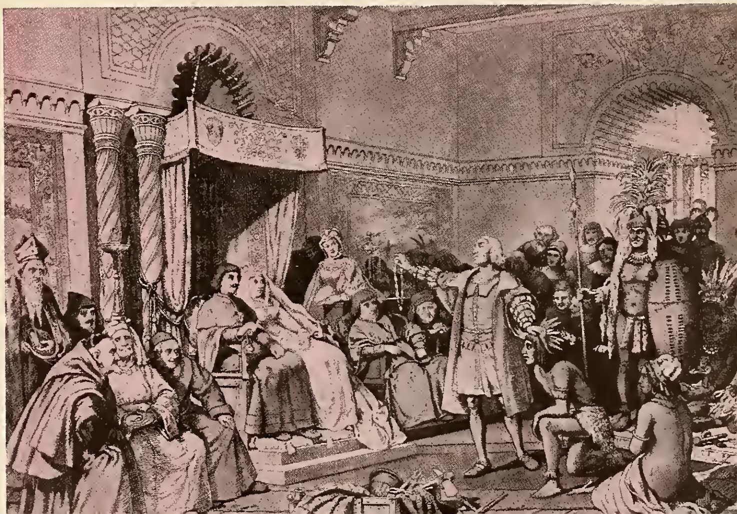
So what becomes of Columbus' San Salvador? It could not be what we now call San Salvador, or Watlings, for that island lies like an outrider along the outer bank of the Bahamas, and it would place the fireworms some 40 miles away from the reefs, in deep water where they do not perform. The "Santa Maria" probably sailed close to the reefs that lie off the northern shore of Watlings, and the spawning lights were seen at that point. The low-lying island itself, about four miles away, passed unnoticed in the pitch darkness. Cat Island is about 50 miles to the west of the reef in question, the right distance for it to be Columbus' San Salvador. That is where his expedition probably first saw land.

It is none too easy to put ourselves back into the fifteenth century and see things as they seemed during the dawn of the Renaissance, when men's minds were stirring but were still imbued with the legends and myths of medieval Europe. It was a time for adventure, but there was little experience. Columbus himself was at heart a mystic and a poet, a man with an overpowering vision, but he was not a professional navigator. The expedition was into the great unknown, and the men were afraid.

Putting out from the Canaries, the ships steered westward, and as the smoking peak of Tenerife sank below the eastern horizon, those on board must have felt that all that tied them to their past lives was severed. But 6 days later and 600 miles to the west, the invisible forces of the unseen world made their first sign. The compass needles no longer pointed to the North Star but more and more to the west, swinging a full degree between night and morning, and all were amazed, for it had never happened before. The

▼ THE RECEPTION of the explorer at the court of Barcelona is said to have been the most magnificent in all Spanish history. He brought six Indians with him and various plants, animals, and minerals from the New World

The Bettmann Arc



magnetic pole was unknown, but the conclusion Columbus drew was sound: the needles do not point to the Pole Star but to an invisible center not far off the line. This discovery alone would have made his name remembered.

The following day "those of the caravel 'Nina' reported that they had seen a tern and a boatswain bird, and these birds never go more than 25 leagues from the land." The phrase is significant, though it certainly does not mean that the hard-bitten sailors on the "Nina" had any great interest in birds as birds. But they knew well, as did every man in the expedition, that the Portuguese had discovered the Atlantic islands of the Canaries, the Azores, and Cape Verde by noting the direction of flight of birds at sea. It was of vital importance to know which birds rested or slept on the sea and which on land, and how far from land they could roam. So we find here a conclusion (based on the presence of the boatswain bird in particular, since it was the more precisely identified) that there was land, probably an island, somewhere within 100 miles. The bird was a sign, but was it a true sign?

All four voyages of Columbus have now been pretty well charted; and when the bird was seen, no land was closer than the Azores, 600 miles to the north. The conclusion was logical; mariners were accustomed to seeing the birds within a certain distance of land. The pitfall lay in the incompleteness of the information, which leads men astray at every turn. What the Admiral and his captains did not know was that tropic birds, or boatswain birds, merely tolerate land for the brief two months it takes to raise their families. For the rest of the year they roam the tropical ocean as far from land as it is possible to get. No one who has ever crossed the Atlantic Ocean between Cancer and Capricorn can forget the sudden visit and shrill whistle of the boatswain bird in tropical waters where birds are scarce — a white, gleaming, long-tailed creature passing on rapidly beating wings and streaking away like an animated comet. Scientists have well named it *Phaëthon,* the son of Apollo, who hurtled from the far sky into the sea. A sign of land or not, no symbol could have better graced the first voyage into the unknown ocean.

A few days later another tropic bird flew by—an early omen in a day long remembered. The compass needles turned a full point to the west, to the alarm and dejection of the mariners. This was at dawn, and it was on that same Monday morning that the weed swept by the ships —weed in which they found a live crab. Seaweed torn from a shore so recently that a hapless crab enmeshed in it was still alive; a boatswain bird; and soft breezes! Is it any wonder that "everyone was pleased, and the best sailors went ahead to sight the land first," all signs coming from the west?

Once again the signs were false, and the ships had yet to reach the mid-Atlantic. But like the variation of the compass, Columbus was seeing for the first time something unknown to Europeans, though the ancient Phoenicians—sailors who once sailed from the Mediterranean to Iceland and ventured far out into the tropical ocean—may have seen it, too. Columbus was entering the Sargasso Sea, a sea of floating weed in the middle of an ocean, a sea that became a legendary terror to seamen of later times. Great masses of floating weed sometimes cover the ocean as far as the eye can see, and strange rumors grew that ships became caught in it, finally to rot and sink.

The reality is otherwise, though no less strange. Sargasso weed, no matter how extensive it seems, hardly impedes a ship, though lack of wind may enhance the illusion. But the weed is peculiar, for it lives and grows as a floating seaweed of the warm oceans, far from land or even shallow water. Its spiky growing tips and bladder buoys give it a distinctive appearance, as Columbus well noted. And it has so long drifted with the ocean currents that sea animals have changed and adapted themselves to a life among the weed as though it were a world in itself, all of them taking on the yellow-brown colors of the floating fronds. Not only are crabs to be found among it, but peculiar small fish called fishing frogs cling to it and are so well camouflaged by color and shape that they are practically invisible. Certain small snails and worms, not to be found elsewhere in the world, also live among the weed.

Ignorance is often bliss, and had Columbus and his men known the sign of the weed and the crab for what it was, their hearts might have failed them. As it was, the weed increased as the ships sailed west, and other signs no less false came to keep their courage high. Ten days and more than 1200 miles from the Canaries they saw boobies and a whale—boobies that "sleep on shore and go to sea in the mornings in search of food, not extending their flight more than 20 leagues from the land," and a whale they thought always kept close to shore. They ran into smooth seas and a drizzling rain —weather that was a sure sign of land. And to cap it all, they saw sandpipers and a dove. Land must be near, and at sunset on September 25, all thought they could see it in the far distance. Columbus knelt down and gave thanks to the Lord.

Where were they? They were in mid-Atlantic, as far from their landfall as from their point of departure, about 1500 miles from the West Indies, from South America, from Newfoundland, or back to the Canaries! Anything that upheld their faith at this time was all to the good. Or perhaps their optimism was wishful thinking. For whales had been seen only close to shore, because men had not sailed far enough to find them elsewhere. Boobies, large sea birds like the gannets of northern seas, had been seen only in nesting colonies on islands, when they naturally stay close to the young they have to feed. And the sailors did not know the sandpipers as the phalaropes that take the ocean for their own; nor did they realize that the dove was a noddy tern, a bird with the size and plump grayness of a dove but one that ranges through the tropical Atlantic.

Hope deferred left boredom in its wake, and at least the sight of boobies—high-sailing birds with a six-foot wingspread—must have relieved the monotony of incessant sailing into a boundless ocean. The mariners knew them well, for like the tropic birds, the brown boobies include the Cape Verde Islands among their nesting places. But also like the tropic birds, they wander far from land when family duties are over. What held the interest of the men on the "Santa Maria" and the two caravels was the proficiency of these birds at fishing. Boobies are called boobies from the Spanish word "*bobo,*" for "dunce," because they pay little attention to human beings and will allow any sailor to knock them on the head with a stick. But they make up for this by their sheer mastery of air and water. Over blue water, where they belong, they dive from masthead heights or higher, suddenly pitching downward and flying fast until about fifteen feet from the water. Then the wings close, and the birds enter the water like aerial torpedoes.

The land so thankfully seen became only clouds on the horizon. Yet hope persisted, for the sea was as smooth as a river, so smooth that many sailors bathed alongside the ships. They saw a good many dorados – high-headed, voracious fish weighing as much as 60 pounds and often 6 feet long. The dorado is as oceanic as the tropic bird and one of the fastest swimmers in the sea. The bathers must have taken some pleasure in its shimmering colors, for they are a brilliant green or blue above, shading to silvery-white below, with purple and golden reflections; and they have bright blue spots on the head and back. Some of the fish were caught, and the sudden fading of the colors as the fish died on the deck made even the sailors silent for a moment.

For several days the dolphins stayed with the ships, and while flying fish are not mentioned in the journal until somewhat later, there is little doubt they were all about, for the two go together. Flying fish are recorded only once during the voyage, about a week later, and then apparently because large numbers actually landed on deck. Maybe it was just as well that most sailors were familiar with them in the seas south of Portugal, for otherwise fish that could fly might have been taken for a sign of heaven, let alone a new earth.

The flight of flying fish is a thrilling sight, no matter how often you see it. The flight starts as a swift rush at a low angle up to and through the surface, usually with the open jaws of a dorado or a bonito close behind. As the fish leaves the water, the lower lobe of the tail vibrates violently and propels the fish into the air at not less than 35 miles per hour. Then the great pectoral fins stretch out stiffly and flight begins; the silver bodies steer up and down the waves and along them, as gracefully as any petrel and at all angles to the wind. The fins are used entirely as planes, and all the power comes from the tail dipping in the water and from the wind itself. With three or four reinforcing dips, a quarter mile may be covered, and perhaps by then the dolphin may have lost the trail.

When the first true sign of land really did come, it was so mixed up with the false that it had no unusual import. On the twenty-ninth day of September, man-o'-war birds or frigates sailed overhead, and in this case the account is almost correct. The bird "makes the boobies vomit what they have swallowed, and eats it, maintaining itself on nothing else. It is a sea bird, but does not sleep on the sea, and does not go more than twenty leagues from the land. There are many of them at the Cape Verde Islands."

Man-o'-wars have been seen to swoop on an ascending booby, seize it by the legs, and turn it head over heels in midair—a sure way to make it disgorge its fish. Yet they probably get the bulk of their food by their own efforts, plunging toward the sea from great heights, making a sound like the hiss of an arrow shot into water, and then, without wetting feathers or feet, rising and tossing up the prey before swallowing it. In actuality, the skittering flying fish are literally caught between the devil and the deep blue sea.

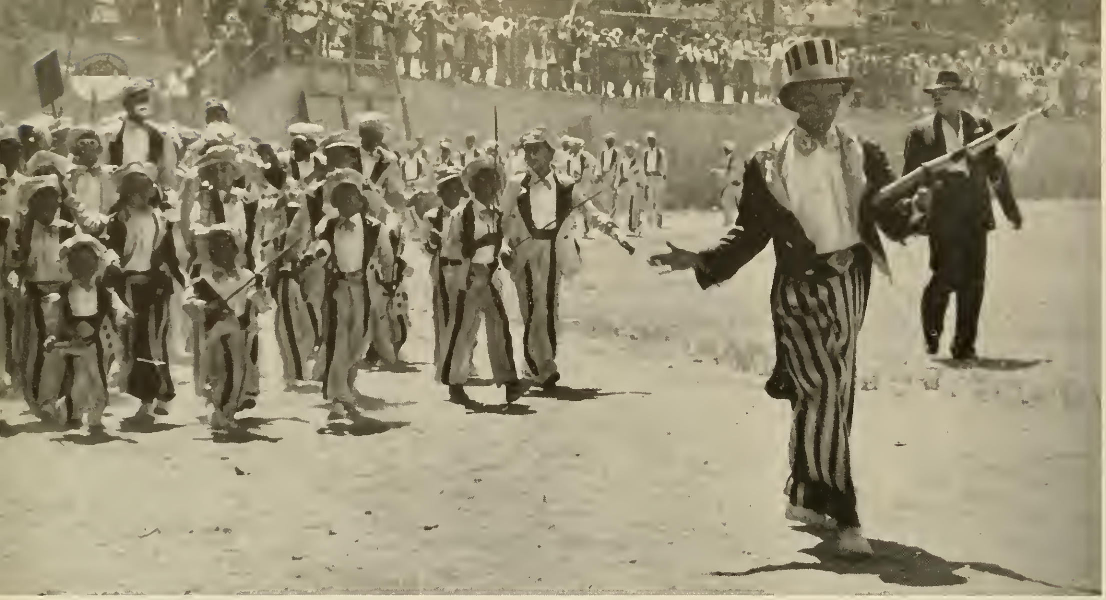
These birds are distinctly not ocean wanderers like their dainty relatives the tropic birds, and they usually cling closely to their island homes. Their great chest muscles make up a quarter of the whole body weight, and the wings are proportionately larger than those of any other bird. Yet despite, or perhaps because of, this equipment, the man-o'-war can only take flight readily from a bush or the edge of a cliff and never rests upon the water. But it can fly through gale and hurricane and can make much longer sorties from the islands than the 20 leagues of Columbus gave them.

When he saw man-o'-war birds for the first time, the nearest land was Puerto Rico, about 700 miles to the south. This is puzzling, for careful studies have indicated that man-o'-war birds do not ordinarily fly more than about 200 miles from their breeding or resting stations. Severe storms have no doubt occasionally carried them farther. Or maybe there is a mistake in identification here.

So for another week, boobies and frigates, dorados and flying fish, and weed marked the track of the three small ships, until suddenly the Bahama banks rose steeply from the deep ocean abyss, and the flat islands of Paradise stood in their way. They had come to land.

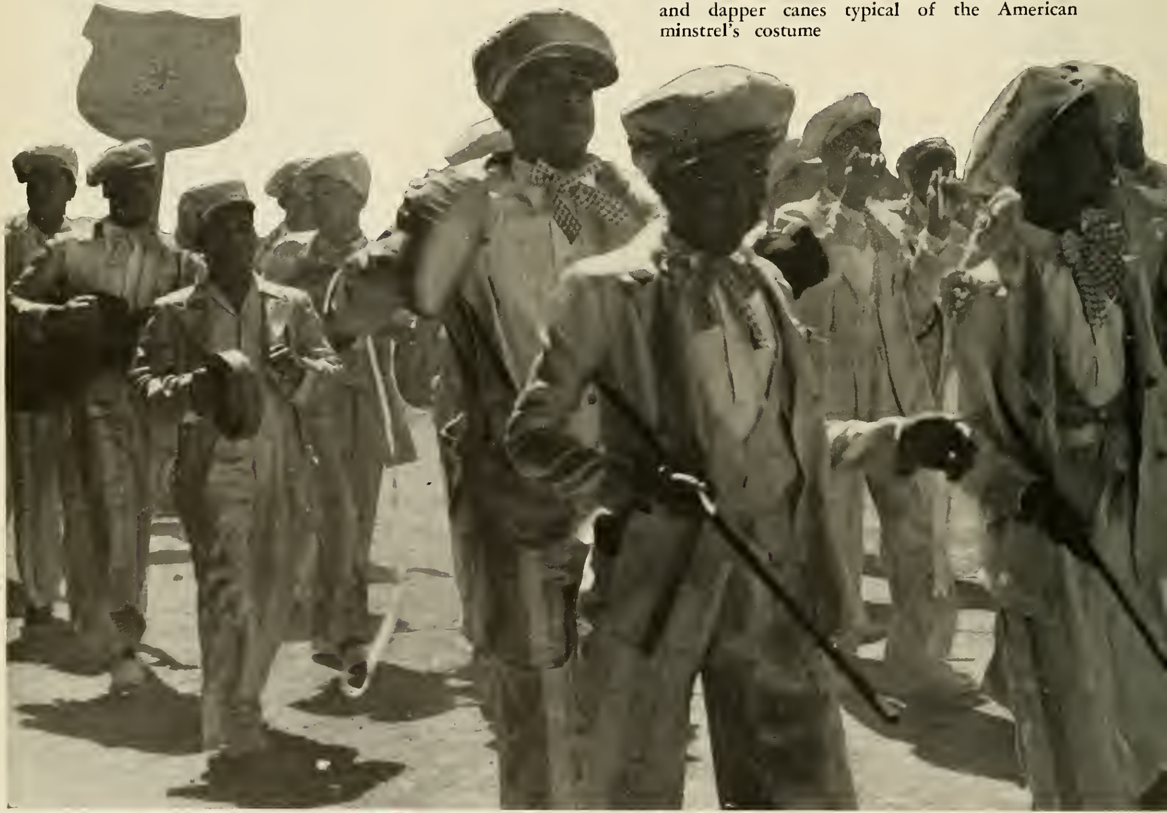
They found the children of the dawn on the islands—comely, naked, gentle Indians who greeted them in innocent friendliness. Columbus was much taken with them and with the soft, calm beauty of the sunny isles; but he had a purpose to fulfill and could not linger long. He went on to take possession of all the little islands for the Sovereign of Spain. But more than this, he was searching for the island of Zipangu, described by Marco Polo as having abundant pearls and palaces roofed with gold. This island (actually Japan) and the courts of Kublai Khan on the mainland of China, were the real objectives, and gold was now the sign to be followed in place of birds and weed. Some gold was

Continued on page 382



▲ "UNCLE SAM" swings his baton as he leads a choral group past the judge's stand. The exciting musical festival of the Cape Negroes is replete with Americana

▼ THESE CHORALERS imitate the long bow ties and dapper canes typical of the American minstrel's costume



DIXIE IN REVERSE

The Negroes of South Africa are borrowing back some of the purely American adaptations that their cousins in the United States have developed

By Quentin Keynes

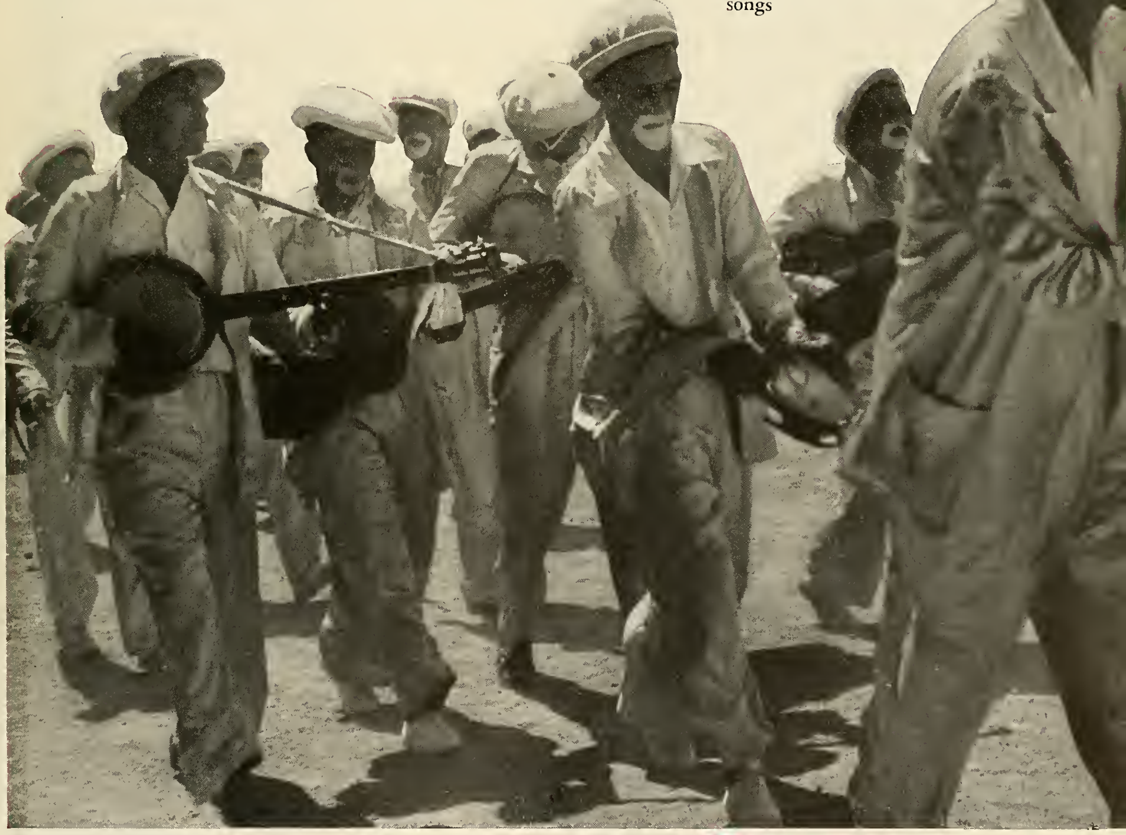
Photographs by the author

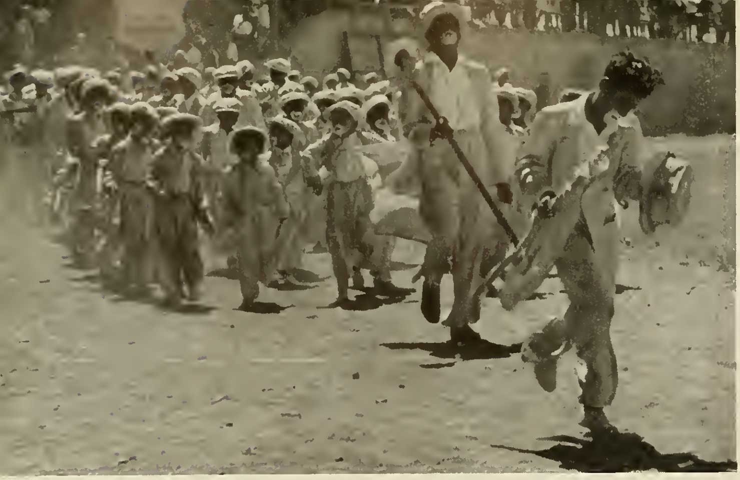
THE cultural elements that the Negro brought from Africa to the United States in slave days did much to enrich American cultural tradition, particularly in musical patterns and dance rhythms. In this country these traditions were influenced, in turn, by other elements quite foreign to the African scene. One of the purely American developments was the minstrel show, which originated here early in the nineteenth century—a kind of musical comedy in which Negro spirituals and humor were adapted to an altogether new national background.

Strange as it may seem, this purely American institution is now being borrowed back by the natives of Africa—but in reverse. At an annual carnival staged in Cape Town, Union of South Africa, the Cape Negroes smear their mouths with white, Al Jolson style, don American costumes, sing American songs, and carry American signs.

Over 1000 of these high-spirited people take part in this carnival at the fairgrounds, chanting many current American and traditional Afrikaans songs. One of the most

▾ Guitars and banjos accompany the singing of current American and traditional Afrikaans songs





▲ "Cakewalking" across the fairgrounds in true minstrel fashion. Lips are painted white, mimicking the Al Jolson style

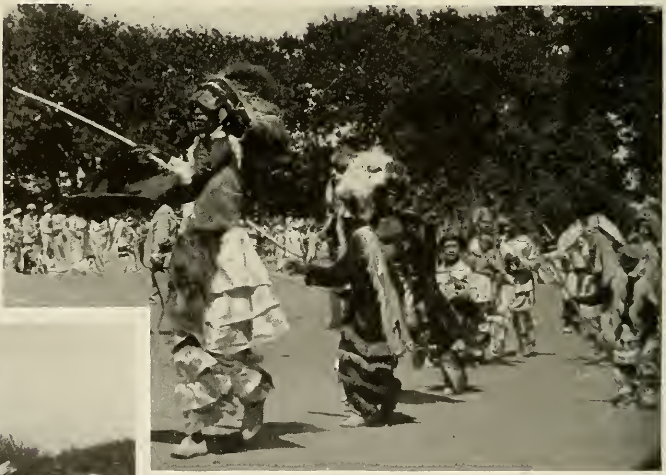
interesting numbers is an old Cape "Malay" melody called "Daar kom die Alabama."

The singers march by in groups to compete for the choral prizes, and each group is good-naturedly identified with the name of an American state. The Louisiana group goes so far as to bring Louisiana into the British Empire by including on the sign: "May God Bless Our Royal Highness Bonny Prince Charles of Edinburgh."

Banjos and painted mouths are everywhere. One figure proudly represents Uncle Sam himself in red-striped pants, top hat, and blue-tailed coat!

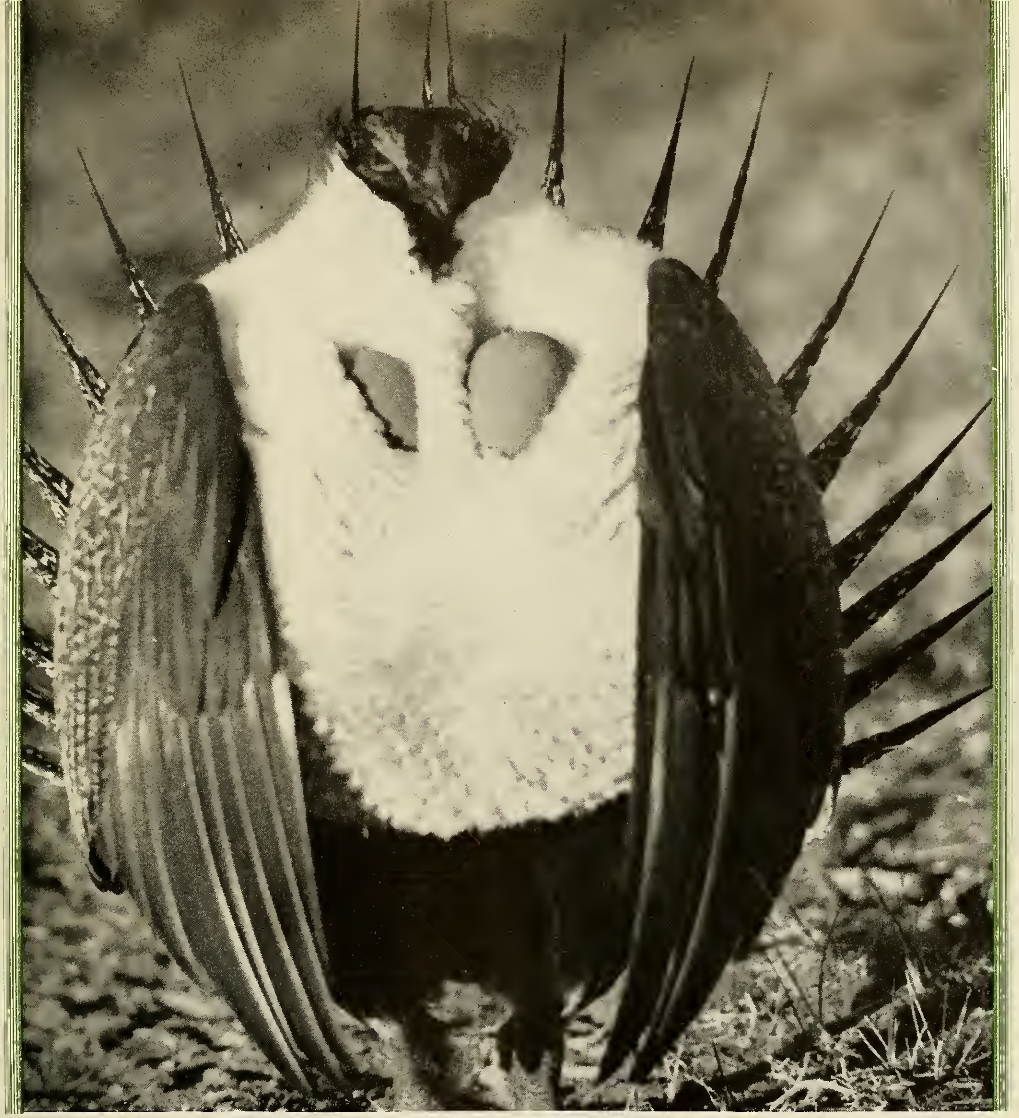
The origin of the carnival dates from the visit of the famous Confederate raider, "Alabama," to Cape Town in July, 1863. As the vessel approached the harbor, a Union barque, the "Sea Bird," which had desperately sought to avoid the Confederate ship for some time, made its appearance from the opposite direction. It was soon evident to the hundreds of local inhabitants, who had by this time lined the water front, that the raider was intent on seizing the hapless Union ship. The "Alabama" fired a blank charge at the fugitive, bringing it immediately to bay, and steamed triumphantly into Cape Town with the surrendered ship in tow. Visitors streamed on board the captor, and her captain was the hero of the day. The happy ending to this story came when the local Prize Court awarded the "Sea Bride" as a legal capture. For years this exciting event was discussed at every bar in the Cape and so eventually found its way into song.

The curious American influence on this musical festival may have come from some members of the "Alabama's" crew who were inadvertently left behind when she sailed. Other sources are undoubtedly the many American movies shown in the theaters of Cape Town. At any rate, everyone concerned has a wonderful and exuberant time.



▲ The "feather headdress" may have been imported from the American Indian or it may represent an adaptation of a native African design

◀ This group identifies itself with the State of Pennsylvania when competing for musical honors. The partially white faces are variations of the white-lips theme



▲ A HEN'S-EYE VIEW of a male sage grouse displaying. At the height of the display, the inflated air sacs, partially hidden by the white ruff, collapse with a *plop* that can be heard for over a mile on a calm day

SAGA of the Sage

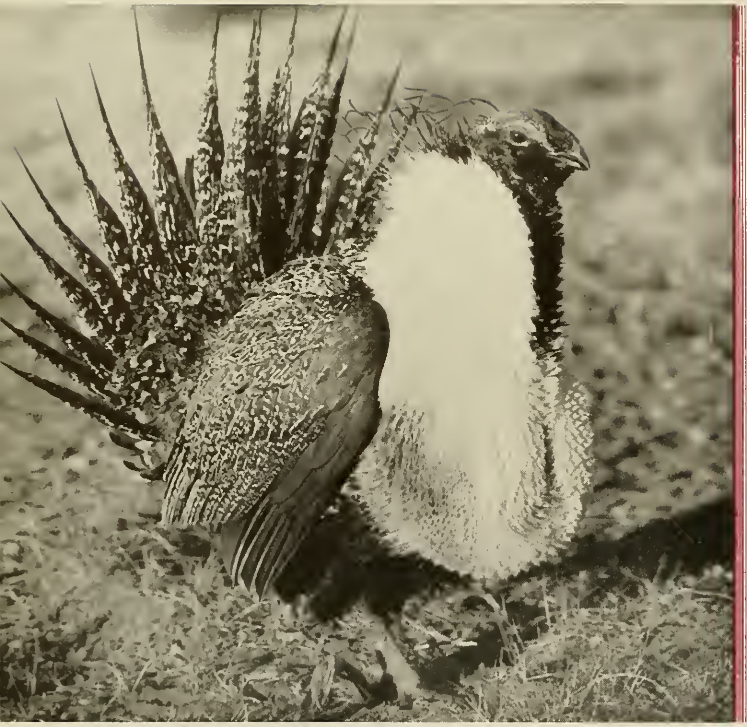
An early morning vigil on the sagebrush plateau of Wyoming results in a thrilling educational film on the courtship ritual of the sage grouse

By CHARLES W. SCHWARTZ

Photographs by the author

OF all avian courting displays, those of our various prairie grouse are among the most spectacular and colorful. Pinnated, sharp-tailed, and sage grouse have in common the habit of gathering each spring on ancestral sites where the cocks perform their age-old nuptial rituals at dawn and dusk.

In the course of filming the sound picture "Sunrise Serenades" for the American Museum of Natural History, which depicts the strange court-



▲ **Some** of the dances and accouterments of the Plains Indians are believed to have been patterned after the displays and plumage of the prairie grouse

ship of these three prairie grouse*, Edgar M. Queeny, producer and photographer, Ralph Piper, sound technician, and I as biologist and co-photographer journeyed to different parts of their ranges. On the vanishing bluestem prairies of Missouri we photographed and recorded the sound of the mincing, dancelike steps of the pinnated grouse and its booming song. The aspen pothole country of southern Saskatchewan and southern Manitoba was the locale where we filmed the running dance of the sharptails. And on the 7000-foot-high sagebrush plateau of central Wyoming we pitched our blinds and recorded the pompous strutting of the sage grouse, shown in these photographs. The latter impressed us as the most spectacular of the three displays.

The strutting ground where we filmed this epic was an opening of little more than an acre in the ubiquitous sage. The sandy soil, supporting a sparse growth of hardy grasses, was marked by numerous grouse tracks, a few scattered feathers, and an accumulation of droppings. According to our host, Bob Patterson, who is making a study of the sage grouse in Wyoming as a biologist with the Wyoming Game and Fish Commission, there were 47 such strutting grounds in the 250 square-mile area he had under observation in this vicinity. This is an average of one ground for each five square miles.

Sage grouse cocks customarily display on their strutting grounds at dawn and dusk from late March until early June. But at the height of their mating season, in mid-April, which we selected as the time of our observations, they may even continue their display throughout the night.

It was 3:45 A.M. when we drove up to our blinds on the strutting ground we had selected the previous day. The headlights of our car momentarily illuminated the scene, and we could see the sage grouse cocks actively displaying. Our sud-

▼ **Edgar M. Queeny** beside one of the camouflaged blinds from which the photographs were taken. His 16 mm. Maurer camera stands on a unipod of his own design. The windows close by zipper

➤ **After** the morning's recordings, Ralph Piper has removed the cover of the blind and is preparing to audit some of the sage grouse sounds den appearance stopped the show; some of the cocks took wing, while others retreated into the shadows of the surrounding sagebrush. We took advantage of this lull to scramble into our three blinds. One was used exclusively for the sound equipment, the other two for photography. All had been placed on the eastern edge of the strutting ground so that the rising sun would light our "stage" to best advantage — a necessity when using color film just after sunrise. The camera blinds were spaced about 80 feet apart in order to achieve different shooting angles and to ensure better coverage of the ground.

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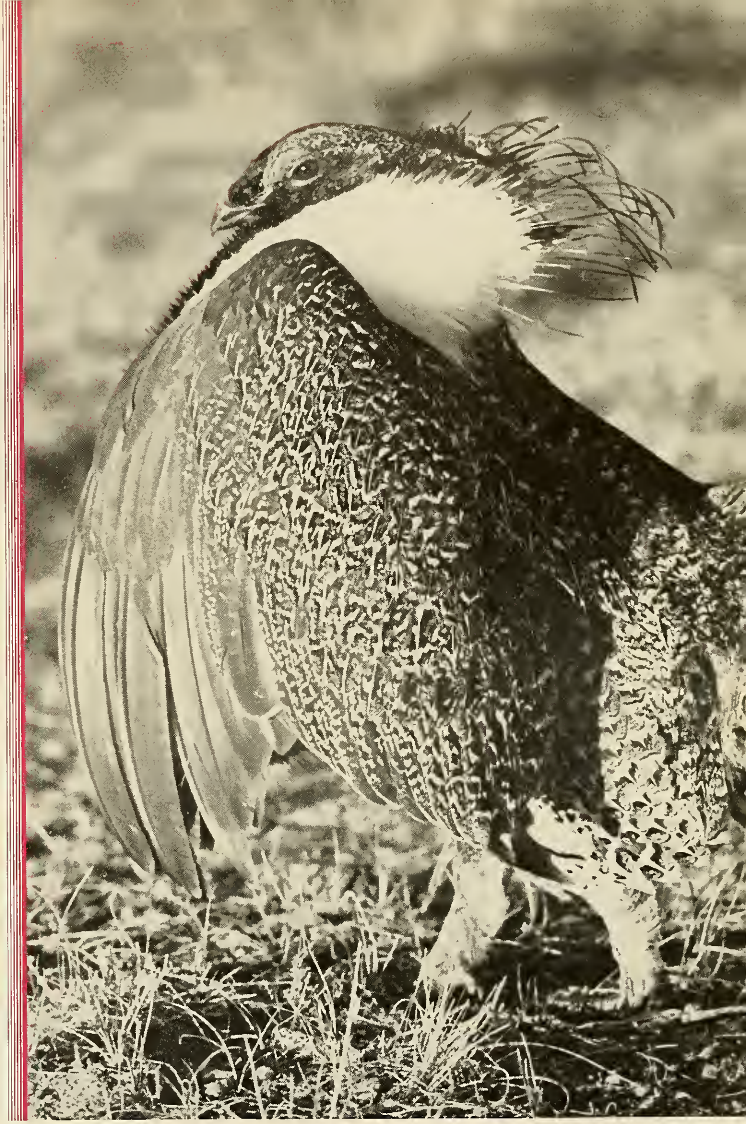
* "Sunrise Serenades" was released recently by Encyclopaedia Britannica Films, Inc. Another motion picture, a ten-minute classroom film entitled "Grouse of the Grasslands," will feature the courtship of the pinnated grouse. This will be released on October 15 by the same organization.—Ed.

Within five minutes the cocks started to return and promptly resumed their displaying. In the dim moonlight, their huge white-neck ruffs stood out like apparitions, and the weird sounds they made while displaying added to the enchantment of the scene. As the darkness imperceptibly dissolved into daylight, the birds became more and more visible. Because the presunrise light was too weak for good color movies, we devoted this time to observing and enjoying the spectacle before us. There were 102 males, rather evenly distributed over the open strutting ground and in the sagebrush roundabout. Patterson told us that the number of males utilizing different strutting grounds varied considerably. The smallest number he had seen was 11, the largest, 450. He believed that on any extensive sagebrush tract the number of males on the strutting grounds represented the total male population for that area. It is probable that each ground is regularly attended by the same cocks.

One cock, which was strutting less than twelve feet from my blind, afforded a splendid opportunity to observe the imposing display. With his long tail feathers spread fanwise, head held high, and wings partially thrust forward, he advanced a few steps. Then, with a slight retraction of the wings and a jerk of the head and neck, which caused the stiff feathers on the basal portion of the



▲ **Profile** of a strutting sage grouse cock. The under surfaces of the wings are scraped against the stiff basal portion of the white neck ruff to create the swishing sound

▲ THE WHITE RUFFS of the strutting cocks cause the birds to stand out conspicuously. Most of the cocks occupy the opening in the sage, but a few possess territories in the surrounding sagebrush

ruff to scrape against the underwing surfaces, an audible "swishing" sound was produced. These movements and the sound, which reminded me of the noise made by lightly brushing a hand over taffeta cloth, were quickly repeated. During these actions, the strutting cock rapidly inhaled and then exhaled the air into the esophagus, whose thin walls thus became inflated to form the pendulous air sacs. After the third inhalation, the air would be quickly exhaled, causing the air sacs to collapse with a sharp "plop," which resembled the sound of an acorn falling into water. The whole process, culminating in the plopping, was repeated successively at intervals as short as ten seconds.

Through the peepholes of the blind other birds could be seen strutting vigorously, and in the quiet morning air the swishing and plopping intermingled in a veritable sunrise serenade. When heard at close hand, these sounds do not seem harsh or loud, but on a calm day the plopping carries for over a mile.

As this grouse strutted pompously before the blind, a neighboring cock, rattling his tail feathers and uttering a grunting sound like a rooting hog, suddenly sidled up to him. Immediately, the strutting cock ceased his display and with a couple of rapid blows of his wings buffeted his opponent, who reciprocated in a like manner. After this round, the two contestants paused for a second or two and then struck out again with their wings. Though the onslaughts were spirited, little damage was inflicted, and only a few feathers floated up out of the swirl of dust caused by the conflict. Following this engagement, the birds paused again, and without further ado the challenger pivoted about and went strutting off to his original stand about fifteen yards away.

We noticed that such bouts were common throughout the strutting ground. It is not unlikely that they represent disputes over territories maintained by individual strutting males. Of course such territories have no hard and fast boundaries, but each male did seem to exert a dominant influence over the few square yards of sandy soil he patrolled. A similar territorial pattern is observed on the courting grounds of other species of prairie grouse.

At the far end of the strutting ground, a few hens could be seen making their way along its edge. Even at this distance they were easily distinguished from the cocks by their lack of a white ruff and by their smaller size and general behavior. In contrast to the pompous appearance of the cocks, the hens seemed almost demure and shy. Occasionally they would pick up a morsel of food, paying scant heed to their ardent suitors, who in the hens' presence displayed even more spiritedly.

Gradually the number of hens increased until ten were grouped in a rather loosely organized flock while four others strayed about the ground individually. The flock of ten spent their time in the vicinity of one particular male, and four of these hens were observed to mate with this cock. Since Patterson had seen 40 females on this strutting ground a few days earlier, it is likely that the peak of mating was almost over and that even fewer hens would appear hereafter each day. Just before sunrise, the hens started to wander off individually through the sagebrush. Those that had mated successfully probably would not return to the ground but would seek a secluded site in the sage in which to nest. Females whose nests and eggs have been destroyed doubtless return to the ground later and mate again, for the cocks continue to display until early June. Thus, the prolonged use of the strutting ground has its function.

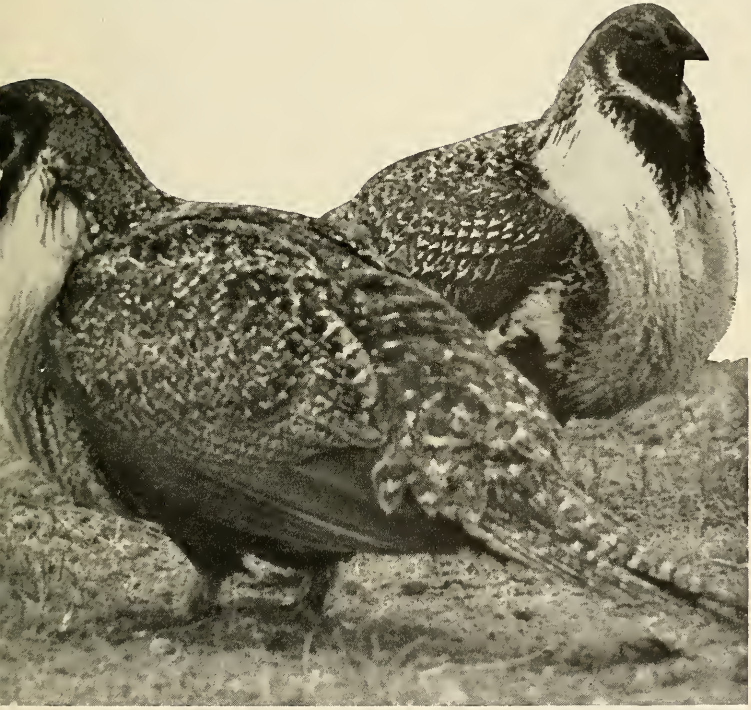
With the departure of the hens, the males' strutting diminished in vigor and frequency, and they spent more time in territorial disputes or just idling and preening their feathers. With the coming of sunrise and its welcome light, we started to record on film the scene we had been so eagerly observing. Although light conditions kept improving for photography, our chances of filming good activity steadily decreased because the climax of the morning's activity had been reached. To overcome some of this difficulty, we resorted to a ruse we had used successfully to stimulate activity in the pinnated and sharp-tailed grouse. We played some of the sounds recorded earlier in the morning during the period of intense displaying by the cocks in the presence of the hens. The results were astonishing. Upon hearing this vigorous plopping and swishing, the cocks were aroused out of their lethargy and were stimulated to renew their energetic displaying. Thus, in good light we were able to secure photographs of activity that otherwise would have been impossible. However, after a time, even this artificial stimulation began to lose its effect and most of the grouse quieted down.

Gradually the birds began to leave the ground, some flying and others ambling off through the sage. By 7:30, all had vanished not to return until dusk, when they would again fill the desert air with the sounds of their wooing. With the departure of the last bird, we eased out of our cramped quarters. Only then did we realize that we had spent four hours witnessing one of the most remarkable of wildlife dramas. While dismantling our camera equipment, we discussed with Bob Patterson some of the problems concerning the future of this bird.

According to him, the original range of the sage grouse coincided with the distribution of sagebrush and salt-desert vegetation. This area roughly encompasses the Great Basin and central Rocky Mountain region from 2000 to 7500 feet above sea level. The bird depends solely upon sagebrush and associated plants for the major part of its habitat requirements during all seasons. In times of heavy snow and severe ground blizzards the sage at high elevations is sometimes covered by snow. Then flocks numbering several hundred birds and composed mostly of females and juveniles may fly as far as 100 miles to lower elevations where the sagebrush remains exposed. Often these areas represent extremely arid regions, which cannot be utilized for breeding range in the summer.

A chemical analysis that was made by the Wyoming Experiment Station shows the leaves of the common sagebrush (*Artemisia tridentata*) to be highly nutritious. The protein content is equal to and the carbohydrate content greater than that of the best alfalfa meal; the amount of fat is twelve times that of alfalfa meal. No wonder the sage grouse utilizes this plant almost entirely as a winter food, since the fat has a high capacity for producing heat. Even during the winter of 1948-49, which is considered one of the most severe in the history of Wyoming, there was no evidence of abnormal loss of sage grouse. They were able to obtain their customary nourishment from the sage.

The inroads of civilization have dangerously lowered the grouse population. Agricultural reclamation projects embodying irrigation of desert land and heavy grazing by domestic livestock have greatly reduced the original domain of the sagebrush and the salt-desert shrub vegetation. A by-product of these "advancements" — indiscriminate shooting — has likewise influenced the birds' decline. The immediate plans for this vast arid domain call for the development of numerous dams and a network of irrigation projects. These will harm not only the sage grouse but numerous other species of wildlife, including big game. Because extensive and contiguous areas of native vegetation are essential for the sage grouse, this bird will inevitably decline unless special provision is made for its survival over reasonably large areas.



▲ TWO SAGE GROUSE COCKS pause before buffeting each other with their wings in what might be considered a dispute over courting territories. Little harm results except the loss of a few feathers

AMNH Photo

▲ PHOTOGRAPH of a greatly enlarged model of the male malarial mosquito (*Anopheles maculipennis* Meigen)

The Lady LIVES ON BLOOD

Little-known facts about a well-known creature—the mosquito

By MARSTON BATES*

Photographs by LYNWOOD M. CHACE
for Encyclopaedia Britannica Films, Inc.,
unless otherwise credited

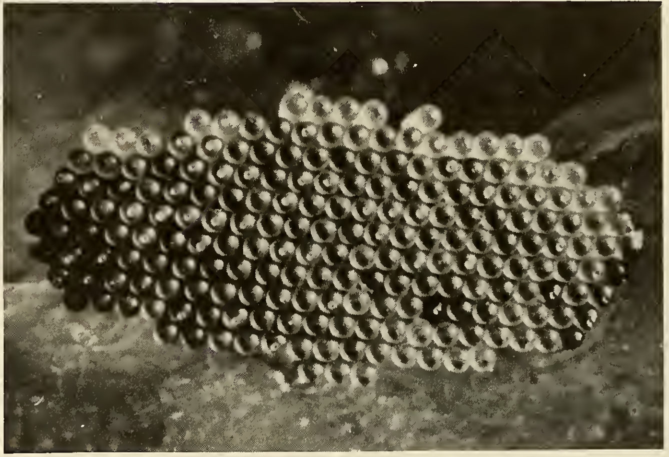
EVERYONE is familiar with mosquitoes. Those poor people who have never been outside the region of Western civilization characterized by modern plumbing may plausibly deny acquaintance with bedbugs, lice, ticks, leeches, or even fleas; but they have all encountered mosquitoes either on picnics or, more intimately, in the bedroom.

Most of us have repeatedly gone through desperate nocturnal conflicts with a single mosquito that has somehow found a hole in the screening and come in to buzz triumphantly first in the left ear and then in the right before settling down to test the blood supply on an exposed shoulder. It is just a test, because the mosquito has already gone when you make the first swat.

I have spent many hours of my life inside large cages with mosquitoes, watching the intimate details of their life, including their individual and collective idiosyncrasies in

◄ A MOSQUITO in the act of laying a raft of eggs on the surface of the water. The larvae of all mosquitoes develop in water

▼ THE RAFT OF EGGS looks like this under strong magnification



biting. I have learned a lot about the character traits of *Anopheles maculipennis* and *Culex pipiens*, but none of this knowledge is of any avail during that midnight struggle. After that first swat, my body tenses in expectation of the next attack. I think I feel a bite and swat again, but a buzz in the ear tells me that the "bite" was probably one of those tricks of sense perception that the psychologists are always fussing with. I decide that the proper course is to let the mosquito settle down and fill up with blood, so that she will go off in a corner somewhere to start the digestive process and stop this silly braggart buzzing.

I try to relax, and presently a series of sensations on one side of the nose informs me that the mosquito has really settled down. I begin to think, why let the brute get away with this? The proboscis, I reflect, is surely well inserted by now and the mosquito sufficiently preoccupied with finding a capillary so that I'll be able to get in a really crushing swat.

I cautiously remove my arm from under the bedclothes and with infinite patience bring it into position for the blow, which is delivered with speed and precision. I feel my bruised nose to see whether I can detect the squashed mosquito. Nothing. Quite possibly the body fell off onto the sheet. But a minute later I hear that damned buzz again. So I crawl wearily out of bed to get the bottle of dimethylphthalate from the bathroom, and after smearing my face, with due regard for eyebrows and eyes (conditioned from times when I didn't take due regard), I sink back into sleep, though still too mad at the *Culex* to be properly grateful for the chemical accomplishments of modern science.

It is, of course, only the female of the species that bites. Not much is known about the food habits of the males, but they have been caught frequently on flowers, or sucking the easily got-at juices of things like fruits and manure. In Albania, I once tried baiting traps for male mosquitoes with all sorts of substances, and I found that I could catch a few with absorbent cotton moistened with perfume from my wife's dressing table. Cow manure was just about as attractive as the perfume, though.

Male mosquitoes are easily distinguished from females because of their conspicuous, feather-like antennae. There are a few records in the scientific literature of attempts

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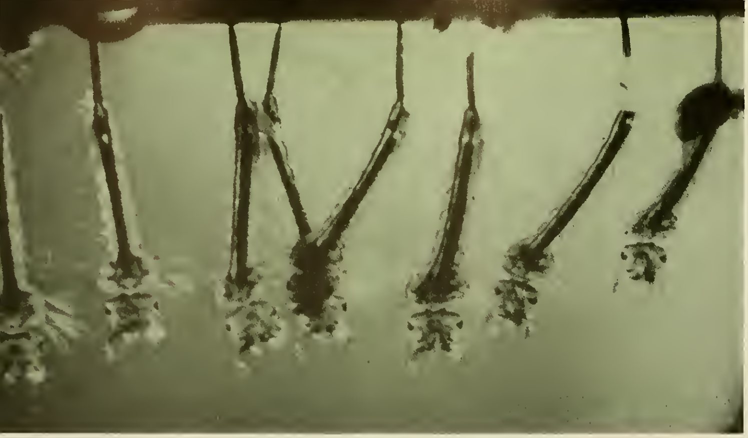
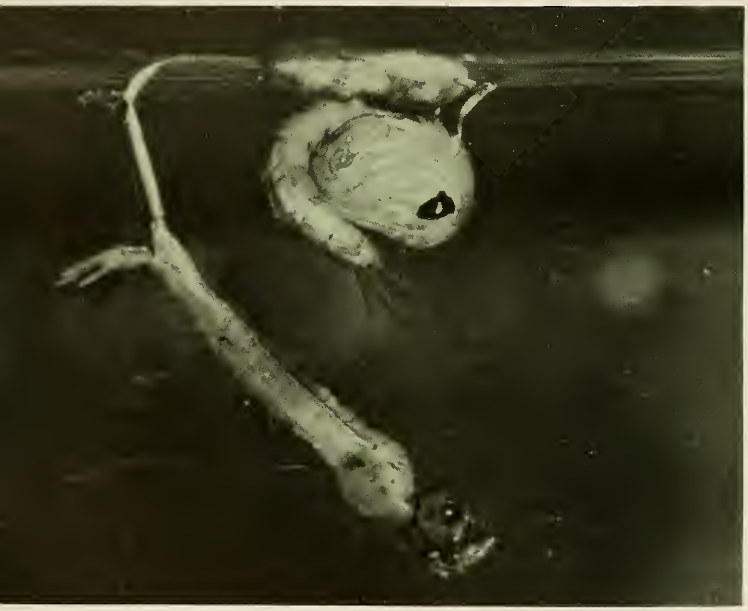
* During his more than 20 years of research, Dr. Bates has enjoyed an unusual variety of field explorations, beginning with several years in Central America and the West Indies. Since 1935, he has been with the Rockefeller Foundation, primarily as a field biologist for the International Health Division—in Albania, Egypt, and Colombia. In Colombia, he headed the Foundation's laboratory for yellow fever research for eight years. He now has a new assignment—the human population problem.

He uses the title of the present article with apologies to Edwin Way Teale, who originated it in a review of Dr. Bates's comprehensive and authoritative book, *The Natural History of Mosquitoes.* His more recent book, *The Nature of Natural History*, is a Natural History Book Club's selection.—ED.



⮝ THE LARVAE hang from the surface of the water and breathe through tubes that reach the air above



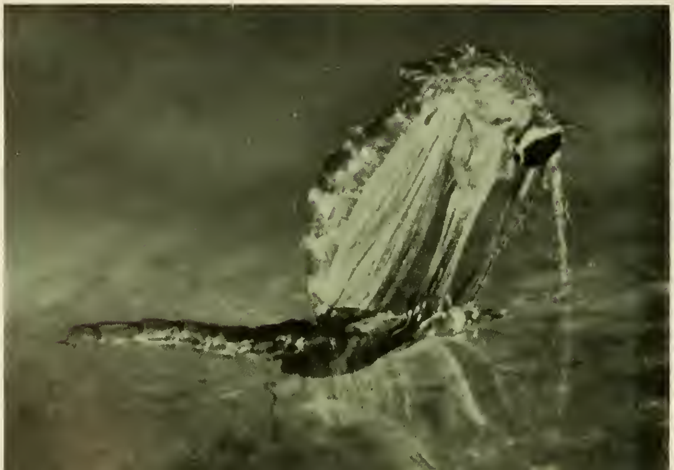
⮝ THE LARVA (*left*) develops into a pupa (*right*). The latter emerges from the larva case, which is seen above it in this view. The creature is still far from resembling an adult mosquito

at blood sucking on the part of male mosquitoes. When such misguided males have been caught and carefully examined, however, they have always turned out to be hermaphrodites—examples of a queer blending of male and female characters in a manner that is characteristic of insects. One side of the body may be male, the other side female, or the head male, the abdomen female, or something of that sort. These anomalies, called "mosaic gynandromorphs," are possible because sexual characters are determined directly by the hereditary materials of each particular cell, and not indirectly through the action of hormones, as is the case with us and other mammals.

It is the blood-sucking habit of the female mosquito that gives these insects their peculiar importance for man. Not so much because of the annoyance caused to the human blood donor as because of the incidental possibility of transmitting disease. Many of the disease-causing parasites of man circulate in the blood stream, and an insect picking up a sample of this infected blood and later probing some new victim for the next blood meal, provides a fine transportation arrangement—from the point of view of the parasite—for getting from one man to another.

The blood sucking habit must be a very ancient one with mosquitoes. Fossil mosquitoes from the Oligocene, some 40 million years ago, look hardly any different from the mosquitoes of today, and presum-

⮞ A CREATURE OF THE WATER transforms into a creature of the air: a female mosquito emerging from the pupa at the surface of the water



ably they had the same habits. There has thus been plenty of time for the mosquitoes and the parasites to work out mutually satisfactory arrangements for exploiting the vertebrate blood supply.

As long as mosquitoes were regarded merely as bedroom or picnic nuisances, they were given very little attention by scientists. But with the discovery, at the turn of the century, of their role in the spread of malaria and yellow fever, two of the most widespread and deadly of human diseases, they came in for a great deal of attention indeed. As a result of this study, yellow fever has been brought as completely under control as smallpox. Malaria is still public enemy number one for a large share of mankind, but in many parts of the world it has been eliminated as a health problem, and where it is still rampant, the difficulty is not so much a lack of knowledge as a lack of the funds and organization for the necessary public health measures. In the course of these 50 years of study, we have incidentally learned a great deal about mosquitoes.

▲ Now the mosquito is completely out of the pupa case, which is behind the insect on the surface of the water

The most recent complete list of the mosquitoes of the world was published in 1932, and at that time 1400 different kinds were known. I once calculated that an average of 40 supposedly new kinds have been described every year since 1932, which would bring the total well above the 2000 mark. But many of the "new" kinds turn out to be mistakes, the new name becoming a synonym of some older name, so that 2000 is probably a safe estimate for the known kinds of mosquitoes in the world.

South America and the Orient have the largest variety, with over 500 species each. About 400 species are known from Africa, and 200 from Australia. North America, with 121 species in the most recent catalogue, and Europe with 125 species, have less variety—but they make up

▲ EXTREME CLOSE-UP of female mosquito emerging from the pupa

▲ THE MOSQUITO in the act of drinking human blood. Only the female bites. Most kinds of mosquitoes cannot produce eggs unless they get blood

for this in number of individuals. As one goes north in either hemisphere, there is a steady decrease in the number of different kinds of mosquitoes liable to be encountered, but there is no corresponding decrease in the number of bites. The world's highest mosquito content per cubic foot of air probably occurs somewhere in Alaska or Siberia.

A man who gets caught in a place where there are millions of mosquitoes looking for a source of blood cannot help but wonder what all of these mosquitoes would have done if he hadn't happened along. All of the evidence indicates that most kinds of mosquitoes cannot develop eggs until after they have secured a meal of blood. If a female fails to find a victim, she is doomed to die childless, her function of reproducing the species unfulfilled.

A French scientist, Emile Roubaud, discovered that one variety of the common house mosquito, *Culex pipiens*, can develop eggs without a blood meal. This discovery led to extensive investigations by many scientists, resulting in dozens of learned papers and in the discovery of four other kinds of mosquitoes that can develop eggs without blood. Curiously these particular species that really don't need blood are among the most vicious and bloodthirsty of all mosquitoes. If they can get a blood meal, they lay more eggs than if blood is denied them; but they can be carried along very successfully in the laboratory for many generations with no richer food than apples and raisins.

For the sake of completeness, I had better note here that there are a few groups of mosquitoes in the tropical forests that have taken up more pleasant habits—bright, metallic green and blue fellows that buzz about in the sunshine visiting flowers. A few have acquired very queer habits indeed, like the African and Malayan *Harpagomyia* that station themselves along ant runways and tease the passing ants into giving up honey. The *Harpagomyia* places itself directly in front of an advancing ant, sometimes even nipping the ant between its front legs, and not releasing it until it stops and opens its jaws, when the mosquito thrusts the swollen tip of its proboscis into the ant's mouth and rapidly absorbs the food offered.

But the basic food association of mosquitoes is with blood, and since disease transmission depends on biting habits, these have received particular attention from scientists. Work on biting habits, for instance, has been important in efforts to discover exactly which kinds of mosquitoes are responsible for disease transmission in different places. Laboratory studies show that any species of *Anopheles* can transmit malaria, but in a given place there may be a dozen or so different kinds of *Anopheles* breeding in different sorts of water. To control them all might be impossibly expensive, and it becomes necessary to determine the relative importance of the various species. It usually turns out that only one species is primarily responsible for malaria in a given region, and by learning the habits of this species, control work can be greatly simplified.

When a mosquito has filled up with blood, she goes off somewhere to digest the meal—a process that takes from two days to a week, depending on the kind of mosquito and on the temperature. She starts with the abdomen red and distended with blood and ends with it distended with eggs. The number of eggs depends on the kind of mosquito, on the amount of blood that she managed to get, and on the kind of blood. Human blood isn't necessarily the best; in one series of experiments, mosquitoes that fed on canaries, guinea pigs, and rabbits produced more eggs per milligram of blood than mosquitoes that fed on men or monkeys. In any case, the eggs are fairly numerous, 100 to 400 being developed per blood meal.

Digestion completed, the mosquito's next problem is egg laying. The larvae of all mosquitoes develop in water—one of the few statements I can make that needs no exceptions or qualifications—so the mosquito must put the eggs in some place where the larvae, when they hatch, will find suitable water. The common domestic *Culex* mosquito finds a rain barrel or puddle, sits on the water surface, and extrudes the eggs one by one, arranging them into a "raft." The eggs are held together by a sticky substance with which they are covered, and the form of the raft is determined by manipulations of the hind legs of the mosquito. Unless disturbed by a water beetle or an inquisitive scientist, the mosquito fixes its whole abdomen-full of eggs into one raft; this finished, it flies off to look for another meal.

The *Anopheles* mosquitoes mostly lay their eggs in ponds, marshes, or areas of quiet water along the margins of lakes. The egg laying is carried out during a sort of hovering dance in which the mosquito bobs up and down over the water surface, dipping down every once in a while to "taste" the water by sticking in a leg (taste buds in insects are mostly on the legs), but otherwise dropping the eggs as she dances along several inches above the water.

Each kind of mosquito has its favored kind of water accumulation for breeding, and some kind of mosquito has learned to utilize almost every imaginable type of breeding place. For the most part, the larvae are closely associated with the water surface, hanging from the surface film and getting air through a tube that breaks the water surface at the tail end of the body. Because of this habit, mosquito larvae are never found in the open water of lakes, where they would merely serve as fish food, or in places where they would be damaged by wave action or water currents. In lakes or large streams, larvae are found in places where they are protected by vegetation; and while many species breed in small, swift streams, their adaptations are to keep out of the current, rather than to resist current action. In such streams, the larvae are found in seepage on gravel bars, in quiet side eddies behind boulders or under waterfalls, and in other places of the sort.

The queerest breeding places are in the tropical forests. In those regions, there are numerous unexpected places in which water accumulates, and every such place seems to have its peculiar species of mosquito larva. I have spent a deal of time in the South American rain forest trying to imagine places where water might occur; if I reasoned correctly and found water, I usually found also some new kind of mosquito.

A very common breeding place is the water that accumulates in rot holes in trees—and such tree holes are used by mosquitoes in the north as well as in the tropics. In South America, the bromeliads—the plants of the pineapple family—provide the habitat of dozens of species of mosquitoes. These plants are epiphytes, living perched on the branches of forest trees, and their long narrow leaves grow out of a water-tight base that forms a structure called a "tank" by botanists. All

▼ **The male mosquito** is recognized by his feather-like antennae. He feeds on fruit and vegetation and has no proboscis for piercing skin

sorts of debris accumulates in this base, forming a rich infusion that provides the plants with food. It also gives shelter to a whole special fauna of aquatic organisms, including dragon-fly larvae and tadpoles as well as mosquitoes. The leaves of many tropical plants allow water to accumulate at their bases—this is true of banana plants, for instance —and even a thin film of water serves for certain specialized types of mosquitoes. The large upright flowers of some plants collect water, and such flowers also have their special mosquitoes.

The forest fauna that interested me most was that of bamboos. The hollow bamboo stems are often perforated by birds or by boring insects, and whenever a hole has been made into the stem, water accumulates in the internode. Some of these worm holes are very tiny indeed, so that one cannot imagine a mosquito squeezing through; yet when the bamboo is cut open, water and mosquito larvae will be found. These bamboo mosquitoes, we discovered, have very special habits. To breed out adults, we would put the larvae in test tubes plugged with absorbent cotton; but these bamboo mosquitoes, when they hatched in such a tube, would simply wriggle through the cotton plug and thus escape. We couldn't keep them in cages covered with ordinary mosquito-proof screen. A bamboo mosquito, coming across such a screen, would simply stick its head into the mesh and wriggle through, instead of futilely

Photo by Mildred J. Ericson

▲ WHERE A STILL DAY means quiet death: a lethal pool on the Upper Terraces at Mammoth Hot Springs, Yellowstone National Park

An INVISIBLE Deathtrap

One of the strangest perils that a bird can encounter

By MILDRED J. ERICSON

AT Yellowstone National Park, mysteries and marvels seem to lie on every hand, but there are few things so startling as a little pool where hundreds of helpless birds meet their doom every year. The innocent-looking little depression, which we may refer to as "Poison Pool," is in the Upper Terraces of the Mammoth Hot Springs formations.

The spot is well shaded and bedded with luxuriant grass, an enticing retreat for any unwary member of the feathered clan that stops for a refreshing drink or bath. The water is safe enough to drink, but death lurks in the carbon-dioxide gas that continually bubbles to the bumping against the screen like an ordinary mosquito.

The growth rate of a larval mosquito varies greatly according to the habits of the species. Those that breed in temporary rain pools sometimes grow very fast indeed, passing from egg to adult in the three or four days that elapse before the pool dries up. Others, that live in protected situations like tree holes, may take many months to grow up.

I have often been asked, "How long does a mosquito live?" Meaning, of course, an adult mosquito. The answer is, "It depends." In Europe and North America, many kinds of mosquitoes pass the winter as adults, hibernating in outbuildings, in caves, or in tree holes. With such mosquitoes, the last blood meal of the fall turns into a fat reserve instead of into eggs, and the adults live for many months in an inactive state.

The conditions of life for such a hibernating mosquito are very different from those for an active mosquito engaged in its proper business of annoying picnic parties. The hazards of existence for an active mosquito must be tremendous, and probably few of them manage to live for more than a few days. Yet to transmit malaria or yellow fever, we know that a mosquito must live for at least a week or two, to complete the incubation period of the parasite. Since these diseases are, or have been, very common, a great many mosquitoes must survive for this incubation period.

I have often wondered how it happens that anyone ever gets malaria, considering all of the hazards of the mosquito transmission cycle. Yet we are sure that we know all of the essential facts about malaria transmission; and millions of people get the disease every year, so the system of transmission would have to be called "successful."

In the United States, to be sure, this transmission system may already have met complete defeat. At a meeting of malaria experts held late in 1949, the specialists were asked how many new cases they had seen during the year among persons living in the United States. Only four new cases were described, although of course there were numerous cases of relapses, or of infections acquired abroad. Not many years ago there were millions of new cases of malaria in the United States every year.

Thus we seem to have the basic information that is necessary for the control of the disease, and in regions with well-developed public health services, malaria is on the way to becoming a medical curiosity. In India, Africa, and much of tropical America, it is still the major human disease, but the need is mostly for expanded public health organization. But even with malaria removed from the face of the earth, mosquitoes would still be valuable and interesting subjects for study, perhaps giving us clues to the general problems that seem to be just beyond our understanding: problems of the adaptations and mutual relations of our fellow organisms, and of the method and direction of the evolution of species.

---

surface. On still days the area is a vacuum of death. Since the carbon-dioxide gas is heavier than air, it then increases its concentration to such an extent that the rapid respiratory systems of its victims are overcome and they drop to a resting place on the ground.

I am certain that these birds do not always lose their lives on the first trip, because wind sometimes keeps the area well ventilated and safe. Sooner or later, however, the birds remain too long on the wrong day.

The number of victims varies according to atmospheric conditions, and the kinds that are overcome seem to depend on the concentration of the gas. On two different tours, I counted 26 birds around the pool's edge, though the daily toll is seldom this large. The birds range from a screech owl found one day, down through the small flycatchers and warblers. Songsters that met their fate here include the evening and pine grosbeaks, green-tailed towhee, western robin, pine siskin, western tanager, white-crowned and chipping sparrows, Audubon's and pileolated warblers, mountain chickadee, red-breasted nuthatch, western bluebird, hairy woodpecker, western flycatcher, and Clark's nutcracker.

No one knows how many birds die here every summer—probably hundreds. An accurate count cannot be made, because animals visit the area at night and feed upon the small feathered victims. Coyotes, martens, and weasels make this their evening dining room, and their diet depends upon nature's fickle mood. Each morning, park ranger-naturalists note that some victims of the previous day are missing and that new ones have been added.

Apparently four-footed animals are seldom if ever suffocated by the gas, presumably because they are not so susceptible to impure air. It will be recalled that canaries have long been taken into mines to detect the presence of poisonous gases. In other portions of Yellowstone Park, animals the size of bears and elk are reported to have been killed similarly, according to observations in 1888 and 1897.[*] However, David de L. Condon, the Chief Park Naturalist, expresses some doubt about this. He informs me that he has on three occasions visited Death Gulch, where the reports originated, to search for the carcasses of animals killed by the gases from the solfatara vents. But he never found any and is inclined to believe that adverse winter conditions may have killed the large animals found there. In fact, he thinks that the calcite springs area below Bumpus Butte might be far more dangerous than Death Gulch.

Be that as it may, "Poison Pool" takes its toll of birds whenever conditions are right, and surely it is one of the most unusual dangers that they could ever encounter.

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[*] *Science*, Feb. 15, 1889; *Science Monthly*, Feb., 1899.

IS AMERICAN INDIAN CULTURE ASIATIC?

Continued from page 351

to this question that have caused most anthropologists to think of the American Indian civilizations as having developed independently.

We must discard, first of all, the land bridges or large islands that have been supposed by some to have existed in the Pacific or Atlantic oceans and to have been routes of migration into the Americas. Geologists and oceanographers are in general agreement that the great ocean basins were never land areas—certainly not during the relatively late geologic periods of man's existence. It seems we must think of any trans-Pacific contacts as having taken place by boat.

The Polynesians in their great sailing canoes were able to cover vast areas of the Pacific and probably did, on occasion, reach American shores. However, our survey of Old and New World parallels has indicated contacts more with continental Asia than with the Pacific Islands. I doubt, therefore, that the latter should be considered as a necessary intermediate step in the diffusion or transport of cultural ideas across the Pacific.

I would look rather toward mainland southeastern Asia, where we have reason to believe that shipbuilding and navigational techniques were well advanced at an early date. Accounts from the second to the fourth centuries of our era record the existence of ships that must have been larger than those of Columbus and other early Spanish explorers, and they were sailed considerable distances, from India to Java and China. Whether or not they could have made the much longer voyages necessary to have reached American shores is another of our problems needing careful investigation.

We have been asking many questions, but that is about all we can do at the present time in regard to the problems of trans-Pacific cultural contacts. We strongly believe that the questions are valid ones and have implications of supreme importance in the scientific study of man's history. They are questions needing more consideration and discussion than have been given them in the past, but we can feel confident that unbiased investigations will lead us surely, though perhaps slowly, to reliable and fairly complete answers.

THE SIGNS COLUMBUS FOLLOWED

Continued from page 365

found at once, small pieces in the noses of Lucayan Indians, gold the Indians told them had come from the islands of the south. So south they went.

Columbus followed the gold and took the gold as a sign. But the broader spirit of the man still shows in his constant delight at the varied and beautiful colors of the coral reef fishes and in his interest in the parrots, lizards, and flowers of the islands, in coconut palms and coconut crabs. Finally he came within sight of Cuba, which he took to be Japan itself, and he resolved to go from there to the Asiatic mainland to deliver in person the Royal Letters to the Grand Khan. On the first day of November he landed, together with his company. For a full month they explored and sailed about the island finding no sophisticated civilization and little sign of gold. Gradually they came to realize that Cuba was not Japan, and Columbus looked upon it more for what it was—a large and lovely island inhabited by ignorant but gentle Indians who lived by simple methods of fishing and agriculture.

After the shipwreck, Columbus became decidedly uneasy. Martin Alonzo Pinzon had already deserted in the "Pinta" in November, and Columbus was uncertain of his own authority on the "Nina," which had Martin Alonzo's brother as captain. When the "Pinta" rejoined the "Nina" early in January, he decided the sooner they set sail for Spain the better. So the ships worked eastward along the north coast of Hispaniola, and it was during these last few days that Columbus saw the three mermaids "which rose well out of the sea . . . not so beautiful as they are painted, though to some extent they have the form of a human face." It is recorded that the Admiral had seen some previously in Guinea on the coast of Manequata, and he announced on this night, in the name of our Lord, that he would set out on his homeward voyage without any further delay whatever, for he had found what he sought.

It is difficult to say what the mermaids meant to him, though his immediate decision to sail for home suggests that they were the last straw. What he saw were the manatees or sea cows of the Caribbean Sea and great South American rivers. What he had seen off the reed-fringed tropical coast of Africa were their close cousins, the dugongs. Sea cows do look half human as they raise their head and chest out of the water to look around. They are, in fact, warm-blooded mammals that breathe air and bring forth their young alive; and the round head, the arm and hand clasping a suckling youngster to the breast, inevitably suggest the idea of mermaids.

So the two caravels set forth on the long voyage home, striking boldly to the northeast, a course that took them directly to the Azores. There is the same day-by-day record of man-o'-wars and boobies, tropic birds and weed, for the Sargasso Sea still lay between. By the end of January food was running low, and it was fortunate that the sailors caught a very large shark (probably a Basking Shark), "which was very welcome, as they now had nothing else but bread and wine, and some yams from the Indies."

Then, on the fourteenth day of February, the day before the Azores were sighted, the caravels were caught in a great storm. During the night of the thirteenth the ships had lain-to in a high and tempestuous sea, and they sailed close-reefed all the next day. Then the "Pinta" ran before the wind, and only the Admiral kept to his course. It was this storm that brought to his mind the recollection of the trees he had seen growing "even within the sea." These were the mangroves of the tropical islands, with their roots in the sea, and he interpreted their peculiar growth to mean that there could be no great storms in the countries he had discovered. At this time he had not experienced a hurricane, which mangroves withstand well.

Such were the signs. Most of them were meaningless or false, yet they served. For it is not the men of action who make the greatest discoveries. The dreamer who becomes a visionary and is stirred finally to set out in search of the Holy Grail goes farther into the unknown and returns richer than the professional, who often knows even too much to start. The signs served Christopher Columbus and upheld his faith to sail on and on into the path of the setting sun, telling him, as he himself had told the Spaniards, that India lay to the west as well as to the east. The signs also whispered to his secret heart that he would find the lost Eden, the Earthly Paradise. But that is another story.

Sequoias Colonize Britain

By John D. U. Ward

CALIFORNIA gold has made its mark on the English countryside and on thousands of parks and gardens throughout the British Isles. The search for gold took men among the Sequoias, and it was between 1846 and 1853 that seeds of both the Giant Sequoia (*Sequoia gigantea)* and the Redwood (*Sequoia sempervirens*) were sent to Britain for the first time. According to one story, the first parcel was sent in a snuff box by transcontinental Pony Express, the mail charge being $25 for 2 ounces.

There was some international disagreement about the name of the Giant Sequoia, for each country wished to honor its national hero. Americans said the tree should be Washingtonia, but the English said that in England it would be Wellingtonia—and it still is! Foresters and botanists refused to squabble: for them *Sequoia gigantea* was good enough, and the tree may now be seen nearly everywhere in Britain. Already there are specimens exceeding 125 feet in height, but unfortunately in Britain the timber is not good enough for the tree to be valuable in forestry.

The famous redwood, *Sequoia sempervirens* is less well known and less widely grown as an amenity tree, but British foresters value it much more highly. The heaviest stand of timber in all Britain is a redwood grove, not yet 100 years old. One tree, which cannot be more than 103 years old, has already exceeded 150 feet in height. As the redwood seems to grow quite as well in Britain as in California, our successors may see in Britain trees as tall as any in the world.

▲ A Giant Sequoia growing in an English garden. In the background is an incense cedar

◀ Thirty-five-year-old Big Trees in Berkshire, with a gigantic future ahead of them. Century-old Sequoias in Britain are over 125 feet tall

LETTERS

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species but here, again, the limits are relatively fixed for each sex.

One possible reason for the nonsurvival of a dwarf bird that might be hatched is the competition of nestlings for the food brought by their parents. An undersized individual could easily fail to receive its proper share. Something of the sort occurs among birds like the owls, where incubation may start when the first egg is laid, resulting in the hatching of the first eggs some time before the later ones. The late-hatched nestlings are, of course, behind their older brothers and sisters in growth and vigor, and in case of unfavorable conditions such as a shortage of food supply, severe storms, or other misfortunes, they often succumb while the stronger individuals survive. If they grow to maturity, however, they are as large as their nest mates. A bulky young cowbird in a nest of baby warblers gives the rightful infants little chance for survival.

"Runt" eggs are not uncommon, but they are abnormal products and probably never hatch. They appear to consist entirely of albumen and shell without the vital yolk, and hence are incapable of hatching. Even if one were to be complete, it is not at all certain that it would produce a dwarf bird.

Male mallards in flight: action photographs taken by Hugo H. Schroder at 1/1000 second

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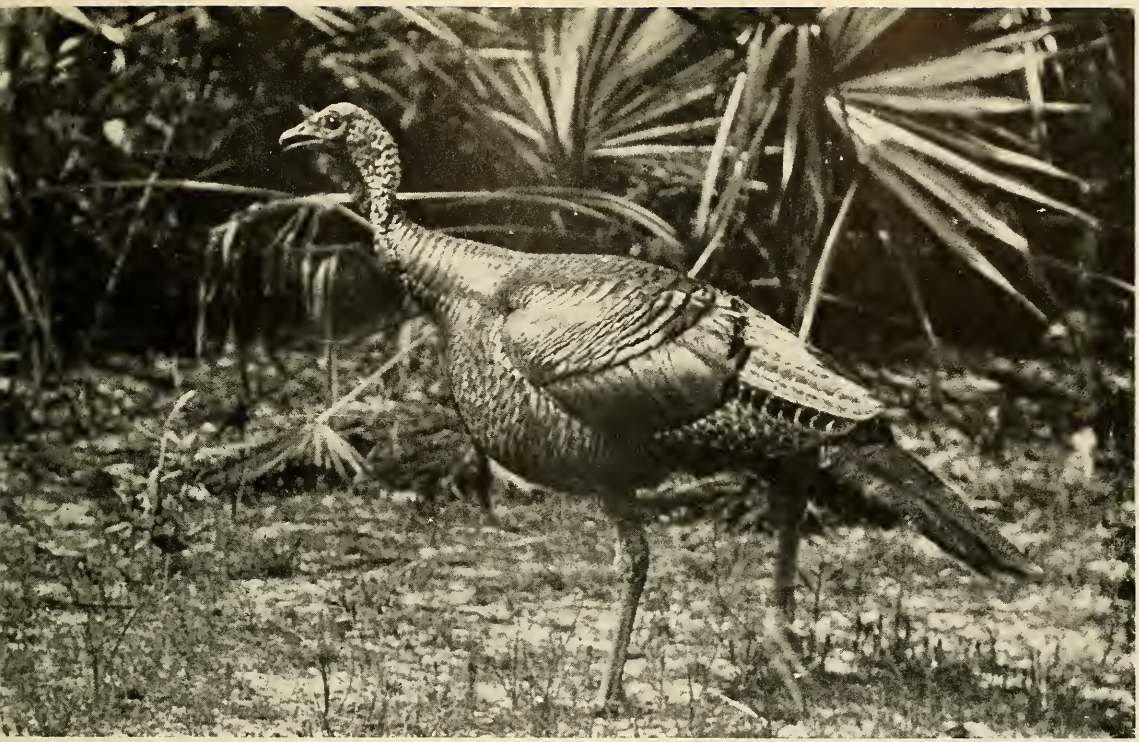


Nicholson photo, from Schroder

▲ A WILD FLORIDA TURKEY, whose "grand uncles" traveled to Europe and back to America to become the Thanksgiving Day symbol

The Turkey—a Bird with a Baffling Name

By JOHN T. ZIMMER

Curator, Department of Birds
American Museum of Natural History

WHEN the early colonists reached the eastern shores of North America, they found an abundance of one bird that they had known as a barnyard fowl in their homeland. In fact, it is quite probable that they brought some of the birds with them. This was the turkey, one of the most characteristic birds of North America and one that Benjamin Franklin later thought should be made the national emblem of the United States in place of the Bald Eagle.

The Spaniards, as early as 1517, found the turkey already domesticated by the Aztecs and took it back to Spain, from which country it was carried to other European areas. The domestic birds were somewhat different from those the English colonists found on the eastern seaboard, having the feathers of the lower back and tail tipped with white instead of rich chestnut-brown, thereby proclaiming their Mexican origin. Local birds may have been caught and tamed, and some barnyard individuals undoubtedly escaped to the woods, so the populations eventually became somewhat mixed in the neighborhood of settlements. The distinctions are still evident, however, though the wild birds have been extirpated over much of their once-extensive range. Several intermediate forms or subspecies occur in the Southwest, and still another lives in southern Florida—somewhat smaller than the northern bird with narrower barring on the wings (see illustration). Various domestic strains have been developed that differ widely from the original stock, and there is a quite distinct species in southern Mexico and adjacent countries, the handsome Ocellated Turkey.

Much has been written about this fine bird, but one question is still uncertain: Where did it get its name? One suggestion has been that it was long confused with the guinea fowl, which may have reached Europe from Africa by way of Turkey and was once known as the Turkey-cock. When the two birds were eventually recognized as distinct (their confusion seems hardly credible), the name turkey was retained for the wrong bird as, indeed, its Latin name *Meleagris* was undoubtedly misapplied. Another account credits the bird with having named itself by its repeated call of "turk-turk-turk—." Which answer is correct, if either, remains a matter for speculation.

LETTERS

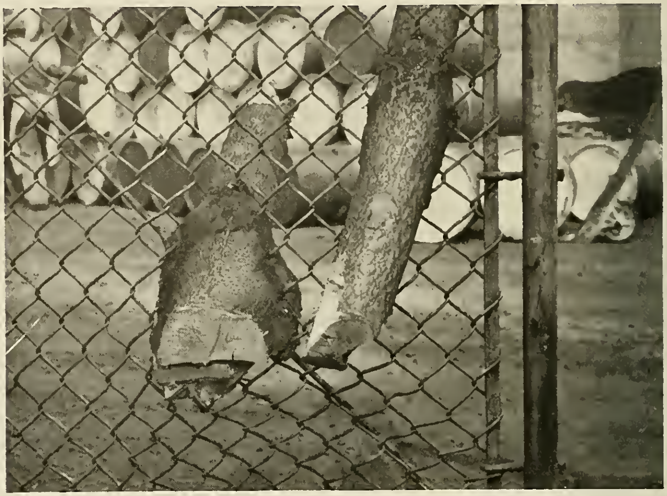
A Persistent Tree

SIRS:

The adjoining photograph shows what happened when a growing tree found a heavy wire gate in its path. The gate had been leaning against a fence for several years, and the tree grew up through it. New construction work made it necessary to cut down the tree, and we were interested to see that the shoots had grown directly through and around the wires, as is shown here.

H. A. RICHARDSON

New York, N. Y.



Geese in Trees

SIRS:

An old pioneer of Clark Fork Valley told me something I could scarcely believe, though the gentleman was well reputed for his honesty. He had . . . lived in the first homestead at Clark Fork, Idaho, and had been a continuous resident of the area since 1883. He said that he had seen geese by the thousands roosting in the trees along Clark Fork River. "One day not many years ago," he told me, "when I went into a store in Hope, an old fellow had just been telling how geese roosted in the trees. No one believed him, so when I came in, he asked me to verify it. I told them that I had seen geese in the trees and that I wouldn't have believed it either if I hadn't seen them myself." My informant did not know why they did this but suggested that, since geese are smart, they may have done so to get above the ground to avoid mink and other animals that prey upon them. Sometimes, he said, they lived in eagles' nests, too. The gander would take possession of an eagle's nest and often fight for two or three days. The gander usually won out when he had plucked out enough feathers; and the eagle never seemed to return. He also said that when the goslings were hatched, the parent geese would fly down to the water with them in their beaks.

Can you give me some enlightenment on these points?

MRS. SUNNIE F. LANCASTER

Opportunity, Wash.

The following remarks are offered by Dr. John T. Zimmer of the American Museum's Bird Department:

It has been reported that the Canada goose sometimes takes to the trees in certain parts of its range and on occasion makes use of the nests of some of the larger birds of prey. Osprey nests, in particular, have been spoken of in this connection. The reports have not been sufficiently numerous or detailed to mention all the kinds of nests that may have been used in this way, but I see no reason why those of the golden and bald eagle might not be on the list.

No reports have come to hand regarding conflicts between the geese and the rightful owners of the pre-empted nests. The nearest approach to information on this aspect of the situation comes in a report of an osprey nest that was found to contain two osprey eggs and three goose eggs. Ospreys and geese were both near by when the observer examined the nest and collected all but one goose egg, and they both resented the intrusion. Later, the single goose egg remained in the nest with the osprey incubating it, and the geese were nowhere to be seen. This would seem to imply that the geese had been the losers.

The Canada goose is a good fighter on the ground, but it might be at some disadvantage in a tree, even with the added foot space given by a nest platform. I am not sure that I am prepared to accept the account of a successful treetop battle with an eagle—a bird of no mean power itself, and certainly more at home in the environment. Such a conflict might possibly turn out as described, especially if the goose had already started incubation and the eagle was only preparing to occupy the nest; but it is doubtful if this is a regular occurrence.

When geese nest in trees, the young are not carried down by the parents but are pushed out of the nest to flutter down by themselves in the manner adopted by various tree-nesting ducks.

Why the birds take to the trees is not always clear, but it has been suggested that some of the localities where this occurs are subject to spring freshets that would wash away a nest placed on the ground. That is one possible answer to the question.

Stolen: One Fish

SIRS:

I have fished for brook trout for many years and fully understand the "hazards," such as trees, shrubs, grass, stumps, and wind. The following incident is something new in my experience. While Harry H. Miller of Burlington, Vermont, was fishing one evening in July at the Lake Mansfield Trout Club, he was about to net a trout, estimated by two experts to weigh ten pounds, when a barred owl swooped down and took the fish from the mouth of the net. A few feet above the water the hook was released, and the owl headed for the woods. It was known that a family of young owls lived near by, and it is assumed that the youngsters enjoyed a treat.

J. M. HOLLISTER

Stowe, Vt.

Dr. Dean Amadon, of the American Museum's Bird Department, expresses the opinion that, though this must have been an unusually bold bird, it should not be taken as any great surprise that a Barred Owl should swoop down and seize a trout that was being netted.

"The Barred Owl," he remarks, "is more partial to swamps and tree-fringed water

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NATURAL HISTORY

The Magazine of the American Museum of Natural History

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VOLUME LIX—No. 9 **NOVEMBER, 1950**

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From a color photograph by W. Bryant Tyrrell

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The Prothonotary Warbler

One of the handsomest of the family of Wood Warblers is the Prothonotary Warbler, shown on this month's cover in a color photograph by W. Bryant Tyrrell. It has no striking pattern of contrasting colors like some of its relatives, but its brilliant orange-yellow head and underparts need no such enhancement. The origin of the bird's name is lost in mystery, having been given to it by Buffon in 1778 without explanation. Possibly it had some connotation of the saffron robe worn by a contemporary church or court official, but the allusion has never been traced.

The bird is a lover of swampy woodlands in the eastern United States, building its nest in hollow stubs over the water, often in the abandoned hole of the downy woodpecker or chickadee. The nests are lined with moss or other soft plant fibers. Usually from five to seven eggs are laid, of a creamy-white or buff color, heavily marked with chestnut-red or purplish spots.

The male's song is simple but loud and clear, and, in addition, he is said to have a softer utterance given only in flight during the nesting season.

John T. Zimmer

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481 pp., 21 figs., 15 plates

THIS book, outlining the development of thought from the theories of Newton to those of Einstein, calls for deliberate and careful reading because it epitomizes the profoundest depths of rationalization reached by man. Although the frontiers of advanced scientific thought lie beyond the perceptive powers of the average reader, the author has kept his text as simple as the subject permits and selected examples most likely to be grasped by a lay reader.

The desire of the public to venture beyond the confines of every-day thought into the mysteries of the Smyth report indicates the need for a book such as this. The more one reads along these lines, the more one marvels at the ingenuity and logic displayed by the master minds of science.

Most of our worldly affairs, and most of this generation's academic background, are conditioned upon acceptance of the theories of Euclid and of Newton. For terrestrial phenomena and for most of man's behavior these theories have worked well. For an atomic age something new has been added, and d'Abro tells us of the steps by which a select few have struck out along new lines of thought. We are told that psychologically man is incapable of grasping the full significance of some of these postulates. To that this reviewer might add that an occasional mental barrier may crop up for the average reader. But as I mounted each new theory as it broke from the corral of common experience I felt a challenge to ride it as long as possible. Intrigued by the daring departure from accepted truth, I took the curves as long as possible, and even if I was flung off into the infinite I intend to go back and start afresh from time to time.

It seems to me that this book will grow on one, that each new study will reveal things not mastered at the first reading. After all, the ideas set forth are the products of centuries of thought. How nice it is to have this boiled down in one volume.

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A NATURALIST IN THE GRAN CHACO

- - - - - - - Sir John Graham Kerr

Cambridge Univ. Press: London and New York, $4.50, 235 pp., 25 illusts.

IN this book John G. Kerr tells the story of his two natural history expeditions to the Paraguayan Chaco. The first trip took him in 1890 up the Bermejo and Pilcomayo Rivers—especially the latter, where he became the good friend of the "woodage" Natokoi tribe of Indians.

The second expedition (1896) led him with his close friend J. S. Badgett, up the Riacho Negro west of Concepción to a mission called Waikthlatingmayalwa, in search of the South American lungfish *Lepidosiren*. They were eminently successful and obtained *Lepidosiren* material in practically all stages of development by collecting in the deep grass swamps around the station.

The Pilcomayo expedition was much the more hazardous, partly because of continuing dissension between members of the expedition, partly because, due to the drying up of the river, boat travel was much delayed and supplies of food ran very low, and partly because, all unknown to him, Kerr was continuously stalked and watched by the Indians as he pursued his work of collecting animals and plants ashore. It was this very watching, however, that in the end assured the Indians that he was a mere naturalist and led them to give him their friendship and trust.

The book is packed with valuable but random jottings on the behavior of the animals, birds, reptiles, and amphibians seen by Kerr, virtually all referred to by their technical as well as colloquial names. This latter fact makes me wish that the author had seen fit to add a technical index, for among naturalists few know that the Indian name for the maned wolf, *Canis jubatus*, is *Aguará guazú* (index, p. 234).

The chapter on the Natokoi is particularly interesting. Kerr lived with them in their camps and was thus especially well placed to observe them.

The "60-foot poisonous serpent" *Bothrodon pridii*, with fangs (plate 8) four or five times as long as those of a rattle-

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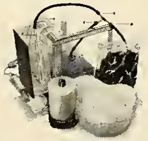

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Duff *By William Marshall Rush*	An informative story of a black bear with superb illustrations by a former member of the Museum staff. The description of the country, the details of bear life and character, as well as much humor add to the interest of this appealing story. Ages 11-15. 244 pages. *$2.25 plus .06 postage.*

The BOOK SHOP

THE AMERICAN MUSEUM OF NATURAL HISTORY

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snake, is not so. C. M. Bogert, Curator of Herpetology, tells me that the tooth in question, of which there is a cast in this museum's collection, is positively not that of a reptile. It may be the tooth of some species of extinct fish.

I greatly enjoyed reading this book. It is simply told and utterly convincing. Perhaps the saddest part of it all (to a museum man) is the fact that the large collections made on the Pilcomayo and left on board the "Bolivia" to be brought out later, disappeared and were never seen again.

G. H. H. Tate

The birds of greenland

- - - - - Text by Finn Salomonsen
Drawings by Gitz-Johansen

Vol. I, Ejnar Munksgaard,
Copenhagen, Denmark, $9.00
157 pp., 17 illusts.

THIS volume of 157 pages, 17 plates, and numerous decorative drawings is the beginning of a bibliophile's treasure. It is published with the support of the Danish Government, and in sumptuousness it harks back to the lavish days of Prince Bonaparte and John Gould. There the resemblance ends, because its text is that of a modern regional survey, and its art strikes a completely new note.

The creators are both Danes who have had long experience in Greenland, and their product springs from fullness of knowledge. The artist, for example, sketched birds and landscape for seventeen years all over Denmark's vast arctic colony—sixty times larger than the home country—before he had an inkling that his work would be put to its present end.

The text appears in both Danish and English, running in parallel columns. Dr. Salomonsen, whose competent use of our idiom is already well known to his colleagues, first wrote the English account and afterwards prepared a free translation into his own tongue. The life histories, headed by the Danish, English, Eskimo, and technical names, treat the waterfowl included in this first of three volumes strictly in terms of their Greenland status. They readably cover the description, range, seasonal movements, feeding and breeding habits, and relation to the aboriginal human inhabitants, together with occasional discussion of ecological or other biological problems. Typical biographies fill (bilingually) from three to eight or ten large pages. They deserve more critical consideration than can be here allotted because of the need to discuss the illustrations.

Ornithologists, whose ideas of bird portraiture are mostly conditioned to stodginess, will probably give none too warm a welcome to Mr. Gitz-Johansen's plates. Therefore, it is timely to say that they represent a noble departure from precedent.

Much more than a century ago, a genius named Audubon, who had received academic training under the French master, David, began to paint the birds of America. Since his time, most illustrators of birds have been at best content to be Audubon imitators, contributing nothing new and in countless instances departing further and further from sound canons by puddling with the muddy pigments of so-called tempora. They have produced thousands of "pretty," gutless pictures that stir no inward flame. Despite such patent degeneration, there are ornithologists who fly in the face of all adequate artistic judgment by condescendingly speaking of Audubon as "a good bird painter for his day!"

Now, Gitz-Johansen is neither Audubon nor a "me too." He has blazed his own trail in the milieu of free, clean, rich, and strong water color, and his impressions of birds will make nobody yawn. True, the plates are not all equally successful; the Greenland mallard, for instance, does not please this reviewer. But the loon, the fulmar, most of the geese, the Barrow's golden-eye, and others are magnificent. If you have any doubt about it, stack them up beside the illustrations in recent American bird books and see which portraits represent the living fowl in its ambiance of land and sea and sky.

R. C. Murphy

Continued on page 432

Not in more than a century— has a book on America's birds been offered to booklovers which approaches the importance of this magnificently illustrated volume.

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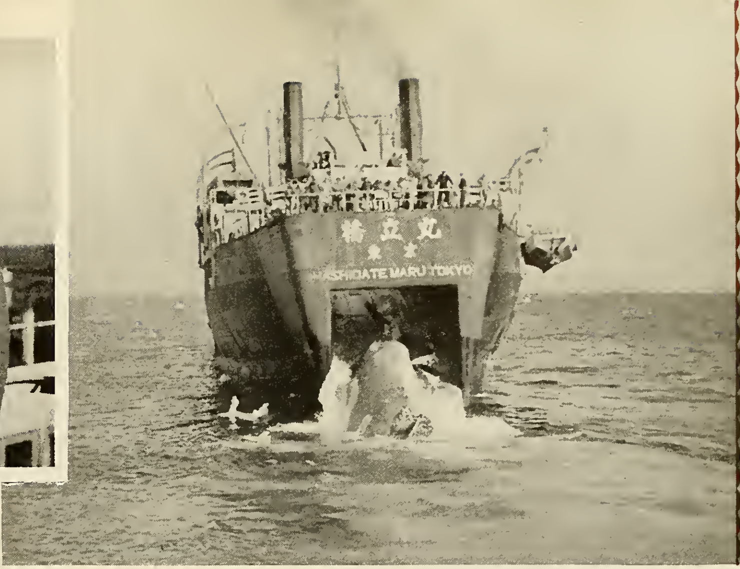
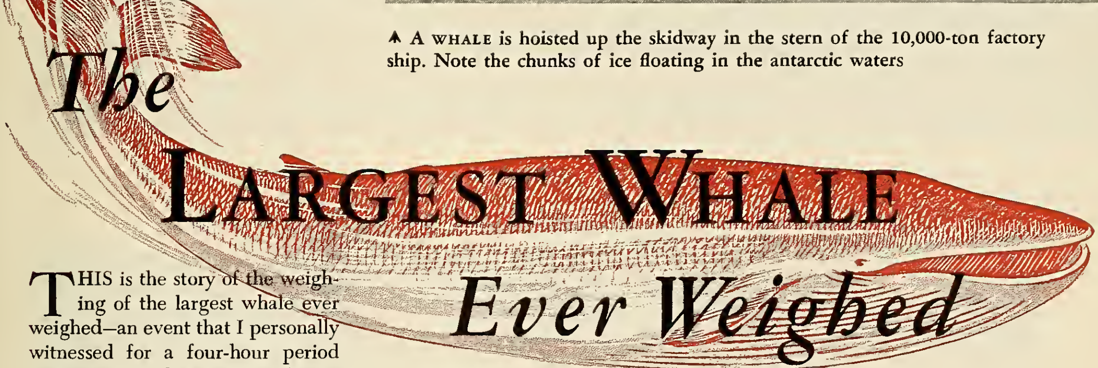
Menaboni's Birds
BY ATHOS AND SARA MENABONI

U. S. Army photo

▲ THE AUTHOR (*left*) and K. Maedo, Chief Inspector. On this unique expedition, 27 whales were weighed in 3 months



▲ A WHALE is hoisted up the skidway in the stern of the 10,000-ton factory ship. Note the chunks of ice floating in the antarctic waters



The LARGEST WHALE *Ever Weighed*

A thrilling whaling expedition into antarctic waters accomplishes, for the first time in history, the mammoth task of weighing on shipboard the giant among mammals

By LT. COL. WALDON C. WINSTON

Photographs by the author unless otherwise credited

THIS is the story of the weighing of the largest whale ever weighed—an event that I personally witnessed for a four-hour period during which I kept notes as fast as chilled fingers could write. It is my impression that such a laborious event has scarcely been undertaken since Jonah's time.

The First Fleet of the 1947-48 Japanese Antarctic Whaling Expedition was unique for breaking precedent and accomplishing the unusual in whaling. There was nothing outstandingly different about the appearance of the twelve-ship fleet—a factory ship, two processing ships for salting and refrigeration, two cold-storage ships, six catcher boats, and an oil tanker—totaling 45,000 tons, except that from its mast waved the International "E" (Easy Flag, modified) authorized by the Supreme Commander for Allied Powers (SCAP), General Douglas MacArthur. Beyond its own territorial waters, no other nautical flag was authorized to occupied Japan. Personnel of the First Fleet aggregated 1300 Japanese, two Allied observers, one an Australian and the other a Norwegian, plus one American, the present writer.

My presence with the expedition was the result of a latent interest in whaling. On June 21, 1947, when I learned of plans for a second post-surrender whaling expedition for Japan, I volunteered as General MacArthur's personal representative in charge of the First Fleet. I was a member of the Natural Resources Section, GHQ. My qualifications were that I volunteered "irrevocably."

My job was to observe Japanese compliance with International Whaling Regulations and directives

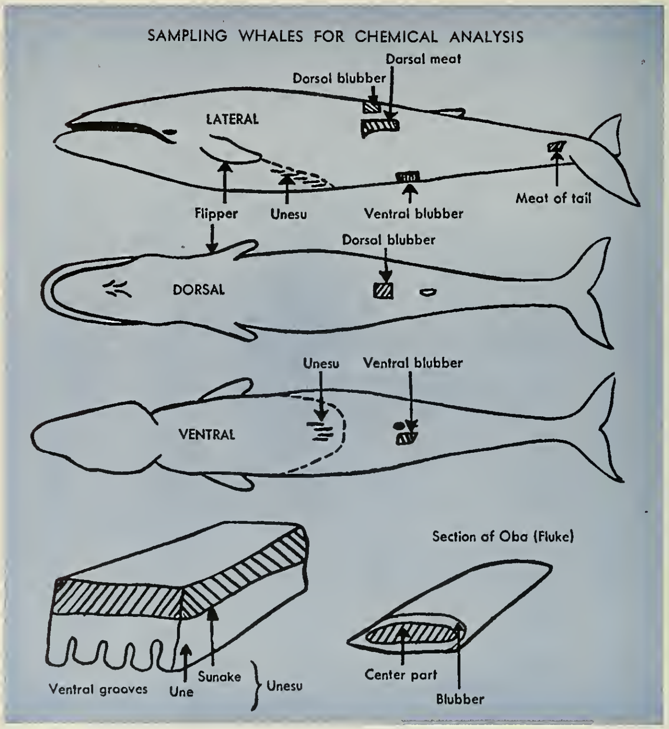
THE THREE-TON TONGUE (seen from over-
ead) is being cut away from the twenty-
hree-foot lower jawbone. What appears to
e hairlike growth is actually whalebone
lates, which serve as a sieve. Scattered
n the plates are part of an unswallowed
neal of "krill," a small shrimp (*Euphausia*
uperba)

▲ WORKMEN STAND about an 80-foot blue whale caught in the Ross Sea about 250 miles from Little America. The whale has been turned on its belly, giving a clear view of its scooplike mouth and of the lower jaw, which juts out beyond the snout

issued by SCAP and to ensure efficiency of operation.

For the first time in my life, I read *Moby Dick* and any other books I could find on whaling. Before leaving Osaka I learned from Japanese biologists, whaling company officials, and experienced whalers that never in the history of whaling had a whale been weighed aboard ship. I resolved that we should accomplish this, and we did so, not once but 27 times during three months of actual operation in the fog-bound, iceberg-infested waters of the Antarctic Basin and the Ross Sea.

Our 6000-mile route to the whaling grounds reversed the island-stepping approach to Japan that led up to V-J Day. Soon after leaving Japan, bloody Iwo appeared off our port, followed by Saipan, Truk, Bougainville, New Britain, and the Coral Sea. We then cruised off the east coast of Australia and into the Tasman Sea and Indian Ocean, and entered the whaling grounds near the Balleny Islands. On the 5th


SAMPLING WHALES FOR CHEMICAL ANALYSIS
Dorsal meat
Dorsal blubber
LATERAL
Flipper
Unesu
Ventral blubber
Meat of tail
Dorsal blubber
DORSAL
Unesu
Ventral blubber
VENTRAL
Section of Oba (Fluke)
Ventral grooves
Une
Sunake
Unesu
Center part
Blubber

of December we killed two sperm whales.

The antarctic season on blue and finback whales, in which we were most interested for their meat and oil, began on December 8. Our hunting took us across the Antarctic Circle several times and into the Ross Sea just off the coast of Antarctica. At one time we were only 250 miles from Little America.

On several occasions I had discussed with Mr. Y. Ogino, the factory manager, my desire to weigh large whales. I informed him that few whales had ever been weighed, and that I was sure we had already processed several that would have outweighed the largest weighed whale on record.

He readily agreed that we would weigh all whales 85 feet and over—to try for a new weighing record. Meanwhile, we conducted numerous other tests.

During the lonely months at sea, I personally investigated many phases of the operation. Japanese officials, inspectors, chemists, and biologists were encouraged to conduct research along lines in which they seemed to have a paucity of knowledge. In a certain sense the factory ship of my fleet, "Hashidate Maru," became a "floating university." Let us hope that our findings on the weights of whales will add something worth-while to the store of knowledge accumulated by others.

From a study of *Discovery Reports* and other scientific books, I had found that the first blue whale had been weighed in 1903 in Newfoundland by Dr. F. A. Lucas, late Director of the American Museum of Natural History. This blue whale, 77 feet (23.72 meters) in length, yielded the following figures:

Flesh	40 tons
Blubber	8 tons
Bones	8 tons
Blood Viscera Baleen	7 tons
Total	63 tons

Captain Sorlle at Stromness, South Georgia, recorded the weights of two blue whales, which were dismembered and weighed piecemeal. The smaller, 66 feet (20.30 meters), weighed 107,812 pounds (48,903 kilograms). The larger, 89 feet (27.18 meters), weighed 268,970 pounds (122,004 kilograms), including 17,637 pounds (8000 kilograms) estimated for blood. The biggest dorsal vertebra weighed 529 pounds (240 kilograms).

Dense fog beset us in the iceberg-infested waters in the vicinity of the Balleny Islands. All ships of the fleet, widely dispersed, had drifted to avoid collision with each other or against the gigantic bergs common to that area. Although we had radar, the Japanese skippers were a cautious lot and were reluctant to move unless they had 1000 yards of visibility.

Shortly after noon on January 27, 1948, with slight clearing of the fog, limited searching and hunting oper-

STATISTICS ON THE LARGEST WHALE EVER WEIGHED

MEASUREMENT OF EXTERNAL PROPORTIONS

Date	27 Jan. 48	BLUE WHALE
Serial No.	319	
Sex	Female	

	FT.	IN.
1. Total length	89	—
2. Flipper to flipper across the back	9	6
3. Circumference, opposite tips of flippers	43	6
4. Flukes, from tip to tip	19	10
5. Length of lower jowbone	22	10
6. Tip of snout to: Blowhole	17	1
7. Center of eye	18	—
8. Tip of flipper	38	6
9. Ear to eye, center	4	7
10. Notch of flukes to posterior emargination of dorsal fin	20	—
11. Flukes, width at insertion	4	8
12. Notch of flukes to: Anus	23	7
13. Umbilicus	36	9
14. End of Ventral grooves	35	3
15. Anus to reproductive aperture, center	2	5
16. Dorsal fin: Vertical height	1	3
17. Length of base	4	5
18. Flipper: Tip to axilla	9	2
19. Tip to anterior end of lower border	12	10
20. Along curve of lower border	13	5
21. Greatest width	3	9
22. Head length	22	8
23. Skull, width	10	—
24. Skull, length	22	5
25. Tail depth opposite dorsal fin	8	2
26. Whalebone, plate length	3	8
Palate stripped from mouth	19	11

WEIGHT OF DIFFERENT PARTS
(Metric Tons)

BLUBBER	
Ventral	4.13
Dorsal	10.11
Jaw	2.58
Head	2.70
Baleen roots	.45
Total	19.97
VENTRAL GROOVES	11.94
BONE	
Vertebrae	7.32
Skull	4.61
Vomer (1)	0.27
Jaw	1.99
Ribs	1.47
Flipper	1.40
Shoulder	0.40
Flukes	0.90
Hyoid (2)	0.08
Waste	0.15
Total	18.59
OTHERS	
Baleen	1.08
Tongue	3.09
"ABA" (3)	1.04
Ovary	0.004
Blood (est)	8.856
Total	14.070

MEAT	
Dorsal	23.06
Ventral	15.99
Chest	4.32
Rib	3.11
Fin	1.17
Shoulder	0.75
Internal	0.73
Head	1.90
Dendo (4)	.39
*Taji (5)	.37
Other	9.44
Total	61.43
INTERNAL ORGANS	
Fat	4.47
Stomach	0.47
Intestines:	
Small	1.23
Large	0.26
Kidney	0.36
Heart	0.43
Lungs	1.09
Liver	1.00
Carotid artery	0.15
Uterus	0.61
Bladder	0.33
Total	10.40

GRAND TOTAL	136.40

WHALE PRODUCTS

	Raw Material	Shrinkage %	Finished Product
Frozen Products:			
Red meat	None		
Ovaries	.004	None	.004
Baleen	.25	40	.15
Salted Products:			
Red meat	51.03	40	30.618
Flukes	.90	20	.720
Dendo	.59	20	.472
Vomer	.27	20	.216
Une (6)	8.67	20	6.936
Intestines:			
Small	1.23	40	.738
Large	.26	40	.156
Heart	.43	40	.258
Kidney	.36	40	.216
TOTALS	63.994		40.484

OIL PRODUCTION
(Metric Tons)

#1 Kverner Boiler	
Ventral grooves	3.27
Tongue	3.09
Taji (5)	0.37
Fat of red meat	9.44
"ABA" (3)	1.04
Gross weight	17.21
Cooking time	4:00
Oil produced	6.3
Per cent	37%
Acid value	0.86
Color:	
Red	6
Yellow	10

#2 Kverner Boiler	
Bones	
Skull	4.61
Jaw	1.99
Ribs	1.47
Flipper	1.40
Shoulder	0.40
Hyoid (2)	0.08
Waste	0.15
Gross weight	10.10
Cooking time	4:00
Oil produced	1.8
Per cent	18%
Acid value	0.74
Color:	
Red	6
Yellow	9

#3 Kverner Boiler	
Internal Organs	
Fat	4.47
Carotid artery	0.15
Stomach	0.47
Lungs	1.09
Bladder	0.33
Uterus	0.61
Gross weight	7.12
Cooking time	4:00
Oil produced	2.6
Per cent	37%
Acid value	0.79
Color:	
Red	6
Yellow	10

Hartman Boiler	
Blubber	
Ventral	4.13
Dorsal	10.11
Jaw	2.58
Baleen roots	0.45
Head	2.70
Gross weight	19.97
Cooking time	3:00
No. of fillings	9
Oil produced	10.3
Per cent	52%
Acid value	0.70
Color:	
Red	6
Yellow	9

#4 Kverner Boiler	
Vertebrae	
Gross weight	7.32
Cooking time	3:35
Oil produced	1.5
Per cent	20%
Acid value	0.69
Color:	
Red	6
Yellow	9

WHALE OIL GRAND TOTAL	22.5
CRUDE LIVER OIL (International unit—110,000)	37Kg.

TOTAL TIME REQUIRED

Measuring	:30
Flensing Dismembering Weighing	3:45
Total Elapsed Time	4:15
Processing Plant Hours	
#1 Kverner Boiler	4:00
#2 " "	4:00
#3 " "	4:00
#4 " "	3:35
Hartman Boiler	3:00
Grand Total Elapsed Time	8:15
Number of men Employed	105
Total Man-hours	546

REMARKS

Color:
Lighter the whale oil the higher the grade. First grade pale yellow; lower grades shade to brown.

All meat possible was cut from bones and vertebrae.

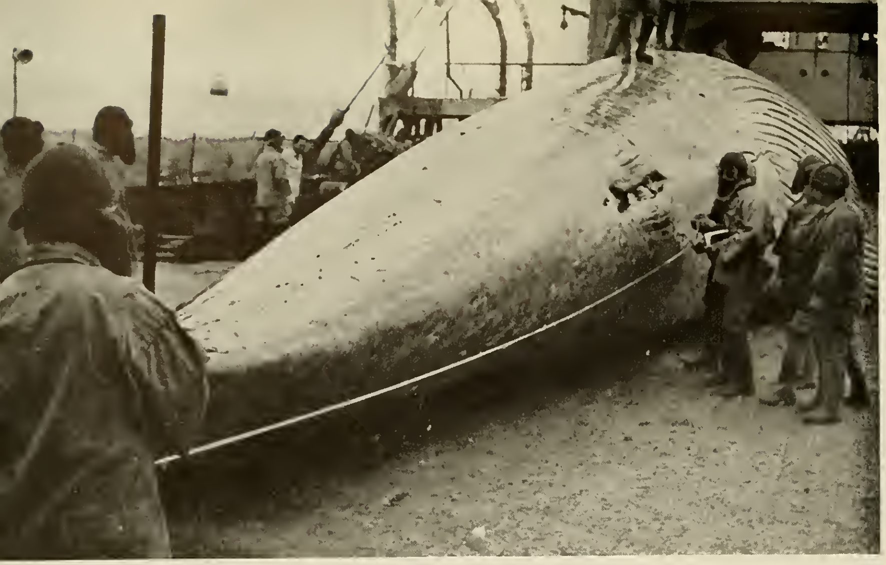
NOTE:

Clinometer (Maximum) during weighing period:

Port	1.5°
Starboard	1.0°

FOOTNOTES

(1) Vomer—Softbone of nose
(2) Hyoid—Throat Bone
(3) "ABA"—Mucous Membrane
(4) Dendo—Fluke Tips
(5) Taji—Jaw Muscle
(6) Une—Fat of Ventral Groove (Belly Blubber)
*Processed for oil



▲ **Measuring the notch** of the flukes on the female blue whale. Never before in the history of whaling had a whale been weighed aboard ship

ations were resumed. At 1410*, "Kyo Maru No. 6" had fastened to a large blue whale. From the bridge of the 10,000-ton factory ship, "Hashidate Maru," we could see the catcher boat silhouetted against the horizon, creeping after her game like a fisherman playing a fighting pike, keeping a tight line, reeling in with huge winches.

Presently from my position on the bridge I observed "Kyo Maru No. 6" drawing its game alongside to be inflated and towed, tailfirst, to the factory ship. A radio message to the factory ship reported that Whale No. 319 had been killed at 1610 and was estimated to be 84 feet in length. I had noted a tendency on the part of gunners to overestimate the small whales and to underestimate the large ones. For this reason I felt sure the whale would be over 85 feet.

I asked the Japanese officials to change plans and prepare for other tests if No. 319 proved to be over 85 feet. This was agreeable to all. As the whale came up the skidway I knew we had a very large whale, but it looked lean to me. Unfortunately, I was right.

The description that follows is summarized from my personal notes taken on the flensing deck as the largest weighed whale in the world was processed.

Ship's Log—27 January 1948

1600 Gentle breeze and misty weather, sea slight.

1635 Received blue whale from "No. 6 Kyo Maru."

At 1705, Blue Whale, female, No. 319 was received on the flensing deck.

Commander Herman K. Sundt, Norwegian Observer, was at the stern with me as the whale, a female, was hoisted aboard. Both of us agreed it was over 85 feet in length, and when it came to rest on the flensing deck we hung expectantly over the inspector's steel tape to verify for ourselves the measured length. It was—glory be—89 feet!

Word passed rapidly among the men, and they knew it would be carefully measured by the biologist and inspector and weighed part by part. The workmen gathered around the gigantic mammal in awe. The huge teats were the size of loaves of bread. The Chief Inspector clambered up the steep ventral grooves and bulging side as if hill climbing. When the outside measurements were finished, the flensers got the signal and the hard work started.

For four hours, I was treated to a kaleidoscopic scene that challenges description. The flensing operation progressed with assembly-line precision, beginning with removal of the huge tail flukes, which measured 20 feet from tip to tip. Numerous workmen swarmed about the 100-meter flensing deck, busily engaged in the tasks of flensing, dismembering, and weighing, while others between decks supervised the processing activities. A whale is usually on its side when hoisted upon the flensing deck. Longitudinal cuts are made through blubber from tail to head, then huge strips of ventral and dorsal blubber are removed in that order. This operation is accomplished by the use of small winches conveniently placed about the deck, while the workmen

**CHEMICAL ANALYSES
ON
DIFFERENT PARTS OF WHALES**

**Whale Serial No. 319
Species: Blue (89 ft.)
Sex: Female
Fatness: L
Freshness: 95%**

**Date of Killing: Jan. 27, 194
Date of Examination: Feb. 5, 194
Place of Killing: Lat. 64–36′
Long. 163–17′**

Parts of Whale	*Water*	*Crude Fat*	*Solids*	*Remarks*
Blubber	25.4%	61.2%	13.4%	(Proportion o dorsal & ventral blubber i 2.1)
Une	25.7	56.8	17.5	
Meat of Tail	58.6	25.5	15.9	
Dorsal Meat	75.0	3.4	21.6	(Below dors fin)
Lung	81.3	1.2	17.5	
Heart	76.4	0.7	22.9	
Dendo	69.9	0.3	29.8	
Flipper (center part)	55.9	13.8	30.3	
Oba (center part)	51.5	12.4	36.1	
Oba (blubber)	56.4	6.3	37.3	
Carotid Artery	74.4	0.3	25.3	
Head Bone	22.9	42.2	34.9	
Thoracic Vertebrae	26.0	21.5	52.5	(8th bone)
Lumber Vertebrae	18.0	48.2	33.8	(11th bone)
Vertebrae	8.9	44.0	47.1	(7th bone)
Jawbone	10.8	36.8	52.4	
Rib	20.2	21.6	58.2	(8th rib middle section)
Vomer	68.8	0.4	30.8	

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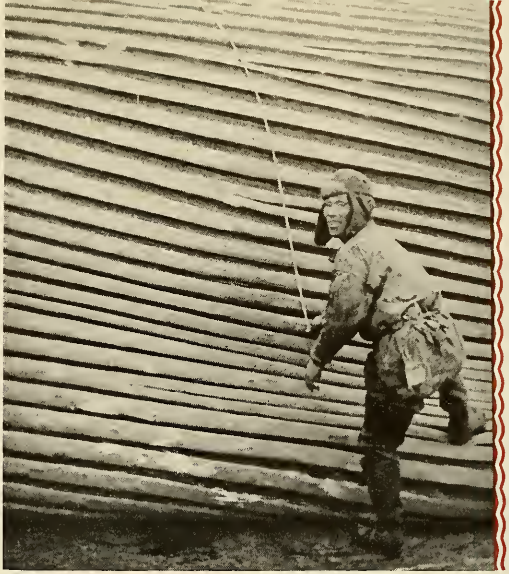
*Time of day is indicated here by the 24-hour clock, in which 1410 signifies 2:10 P.M.

▲ It required 80 men 3 hours and 45 minutes to flense, dismember, and weigh this 89-foot blue whale



▲ With steel tape these men are measuring the circumference of the blue whale. During the many phases of the gigantic weighing operation, anatomical analyses were made that should contribute to the knowledge of this largest of all mammals

hack at the connective tissues with long-bladed flensing knives.

The rubbery three-ton tongue and ventral grooves came next. Huge 11½-ton loins of rich, red meat peeled from the carcass ahead of spareribs weighing about 1.4 tons. A great mass of internal organs, weighing about 10 tons, spilled from the abdominal cavity. Flank blubber, meat, and ribs pinned on the underside were stripped off in order as the mammoth head was severed from the backbone.

All that remained was the job of separating the vertebrae, joint by joint. Blubber was stripped from the huge snout, and the 23-foot jawbones were severed from the skull.

By the time the whalebone, or baleen, was stripped from the roof of the mouth, the flensing and dismembering operation had reduced the erstwhile monster of the deep to a stack of blubber, bones, and meat.

Dodging chunks of blubber and meat as they were shunted about the deck for different phases of weighing and processing, I seemed to be at the hub of activity amidship near the winch deck. Mr. Ogino, the factory manager, stopped to inform me that the fluke tips had been cut off by the catcher boat to reduce resistance in towing but that they would be brought to the factory ship for measurement. As great blankets of blubber were ripped from the carcass, Keijiro Maeda, Chief Inspector, remarked, "This whale no fatness," and we put down "L" for lean.

"Yes. Very sorry, because I had hoped for a fat one this time," I responded as he moved forward.

At the loading chute and three other points on the deck, the most important activity of the whole operation was progressing. They were weighing chunks of blubber, meat, and bone cut into 40- to 50-pound pieces on small platform scales such as one finds in a feed store. Imagine weighing a herd of cattle, piece by piece, across scales unable to handle more than about 200 pounds at a time. This is how we weighed the largest weighed whale in the world, totaling approximately 300,000 pounds!

Workmen laughed and leaped aboard loins that were skidding forward to the loading chute. Others there started a chanty. Everyone seemed happy. Over and over, they filled the box on the small platform scales, then emptied the contents down the loading chute.

The rattle of winches was continuous as cablemen ran about the deck following their systematic plan of dissection. Small, two-man bone saws with link chain blades were used to cut up the smaller bones.

Hayashi, the biologist, and a chemist moved about the deck selecting various samples for later analysis and study. The ship's doctor and an assistant examined the rotund chin from which whiskers had already been plucked. From past experience I had found that most of them break off at the roots. Whale whiskers are very brittle.

The biologist cut into the huge stomach to examine its contents. Baleen whales feed upon small shrimps, referred to among whalers as "krill," which are found in great swarms along the edge of the ice pack. The species and quantity of shrimps found in the stomach and the degree of digestion were noted by the biologist.

A furtive movement at my flank caught my eye. A silent workman was tearing by hand the covering from the 950-pound heart. Fearfully, he glanced at me as if I might take from him a prize of great value. His dogged determination as he flaked fat from the covering held my attention. The chemist, observing my interest, informed me that the

▲ A TYPICAL ANTARCTIC scene, as seen from the factory ship. All the ships in the fleet were widely dispersed, to avoid collision with each other and with the gigantic icebergs

covering can be processed for a drumhead — Buddhist style. The worker looked at me less fearfully now and by gesture indicated beating of a drum. "Heart covering usually very thin," continued the chemist, "this very thick." I fingered the covering and found it thick as buckskin.

While I was standing on a twelve-inch ledge near the blacksmith shop, a chunk of head meat — nearly half a ton — came sliding across the deck, splattering my clothing and notebook. The cableman looked up at me apologetically as if expecting some critical or derisive remark. I laughed. How could anyone expect to move freely about a flensing deck without getting his clothes dirty! Had the ledge not been there, however, one can hardly say what might have happened.

The factory ship was equipped with six Kverner boilers (twenty-ton capacity) for processing oil from blubber, bones, and meat, and one Hartman boiler (ten-ton capacity) exclusively for processing oil from blubber. There were also settling tanks, centrifugal separators, storage tanks, and a complete plant for processing crude vitamin oil from the one-ton whale livers.

For three years I have worried about my ability to put into words what I saw and felt about this strangest experience of my life. I always want to take everyone by the hand and lead them through each interesting detail. Many have patiently endured this explanation, but I can't say they would care for a repeat performance.

Mealtime had passed by more than an hour when I moved toward the boat deck and my cabin.

"You missed your meal," observed Kenneth Coonan, Australian Observer, as I approached.

"Yes, but I've been waiting for this all season. I can eat any time," I replied, still excited over the spectacle. I continued with my notes as he gazed curiously out upon the mass of blubber, bones, and blood. My hands were so cold from writing barehanded that I had to stop and rub them vigorously to bring back the circulation.

A finback whale was brought upon the deck as I finished eating. I hurried out to delay flensing operations until the deck was completely clean. Number 319 had been brought upon a clean deck, and I wanted it clean before another whale was flensed. This way I could vouch for the weight of the whale. "Saito! Saito!" Where was my interpreter? Returning inside I found Yamagami, my photographer, and sent him for Saito. Impatiently I waited for him to appear. Briefly, I explained why they must wait before flensing another whale, and he hurried off to see Yuge, the chief of the flensing operation. That was settled!

The deck was clearing fast. The last big section of vertebrae was dropped into No. 4 Kverner boiler, and the men who hooked it in followed it with their eyes as it plunged into the heap of bones and meat below. They looked at each other and laughed as if congratulating themselves that it had not stuck in the opening, from which they sometimes had to probe huge bones with a long iron bar. Two boilermen appeared and began to close the door and to put on the cover before steam at 60 pounds per square inch could be applied.

No. 3 and 4 Kverners were soon closed, and the rib sections moved across the deck to No. 2. Most of the 61½ tons of meat had disappeared down the loading chute, and men were cleaning up around the bone saws to collect flakes and scobs of bone torn out by the heavy-bladed saws.

The chief of the flensing section, Yuge, laughed good-naturedly and spoke to Saito. I looked inquiringly his way and Saito explained, "He says that in seven seasons in the arctic and antarctic this is first time he has ever seen a Japanese factory ship processing a whale this way."

"You can tell him that this procedure has probably never been followed before on any whaling factory ship in the world," I replied.

Covers had been placed on No. 1 Kverner boiler containing ventral grooves, tongue, *toji* (jaw muscle), fat of red meat, and *aba* (mucous membrane). The last ribs were dropped into No. 2. The boilermen let themselves down into the two-deck opening to close the doors of the great boilers, containing over ten tons of raw material. This boiler will hold nearly twenty tons of meat and blubber, but we put only bone in No. 2 in order to determine the percentage of oil produced by actual processing.

It had required the efforts of 80 men about 3 hours and 45 minutes to flense, dismember, and weigh, part by part, this largest whale ever weighed. Twenty-five more were working below in the processing section.

Through binoculars, I had watched "No. 6 Kyo Maru," only a few miles distant from the ship, when she secured this whale. It must have been only a few minutes after the whale was harpooned, because I could see the harpoon line hanging down from the bow and finally the slow roll of the animal as it was brought along from the bow and secured to the catcher boat for towing tailfirst to the factory ship.

Later, Sutekichi Kikuchi, the gunner, told me that firing the final harpoon into the huge creature had been difficult because each time the catcher boat drew the animal within range, it would dive. For two hours the struggle continued until finally the *coup de grâce* could be administered, and the spirit of the huge leviathan, "Kujira Kuyo," was released to rove restlessly in space until, reconciled for its untimely demise by the annual Buddhist ceremony "Kujiro No Kuyo," it could journey into whale heaven and become Buddha.

It was possible to weigh this whale on regular platform scales because the ship was stabilized by 600 tons of sand ballast. The roll of the ship averaged an arc of less than two degrees on the clinometer during the flensing, dismembering, and weighing, because there was only a slight sea at the time. A test observation revealed maximum roll to be one degree starboard and one and one half degrees port.

When weights of blubber, bones, meat, internal organs, and other parts were added up, we had an actual weight of parts of 281,087 pounds, or 127.5 metric tons.[*] Estimating the blood and stomach contents at about 19,500 pounds (8.856 metric tons), Blue Whale No. 319 weighed approximately 136.4 metric tons, or 300,707 pounds!

Whale oil produced was 22.5 metric tons (133 barrels), valued in 1948 at approximately $440 per ton, or $9,900. Red meat stripped from the body weighed 61.4 metric tons. Allowing for shrinkage, frozen and salted products totaled 40.484 metric tons. The meat products were valued at approximately $18,000. The total value of all products exceeded $27,900 from this one whale carcass. Without shrinkage from salting, it would have been more. You will notice that the meat, which is often considered of no importance, was actually worth about twice as much as the oil.

Upon our arrival at Osaka, the Japanese lost no time in announcing in their *Shimbun* (newspapers) their accomplishment in weighing the largest weighed whale in the world. Apparently this "scooped" all Allied newspapers. I had received confirmation on previous whale weights from the International Bureau of Whaling Statistics, Norway, a few days prior to landing and so informed the Japanese. I thought it was a "scoop" accomplishment myself, but others were slow to share my enthusiasm. Larger and heavier whales were caught by the expedition, but they were not officially weighed and recorded. The First Fleet had weighed 27 whales (16 blue and 11 finback) and recorded them—a record-shattering event on any whaler's logbook!

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[*] A metric ton is 1000 kilograms, or 2204.6 pounds.

▼ CHUNKS of blubber, meat, and bones, cut into 40- to 50-pound pieces, are weighed. The four small scales that were used were unable to handle more than 200 pounds at a time

▼ MEASURING THE SURFACE area of the whale was a laborious task accomplished by Biologist T. Hayashi (*left*). K. Maedo assists, as the author looks on

U. S. Army pho

Tiger of the Grass Roots

The short-tailed shrew has an appetite for twice its weight daily and carries poison enough to kill 200 mice

By Tom McHugh

Photographs by the author

"It is a ravening beast that biteth deep and poysoneth deadly," wrote one 17th century naturalist. He was not describing some prehistoric monster. He was referring to a very tiny, sharp-nosed creature called a shrew, which at that time was feared as much as a viper.

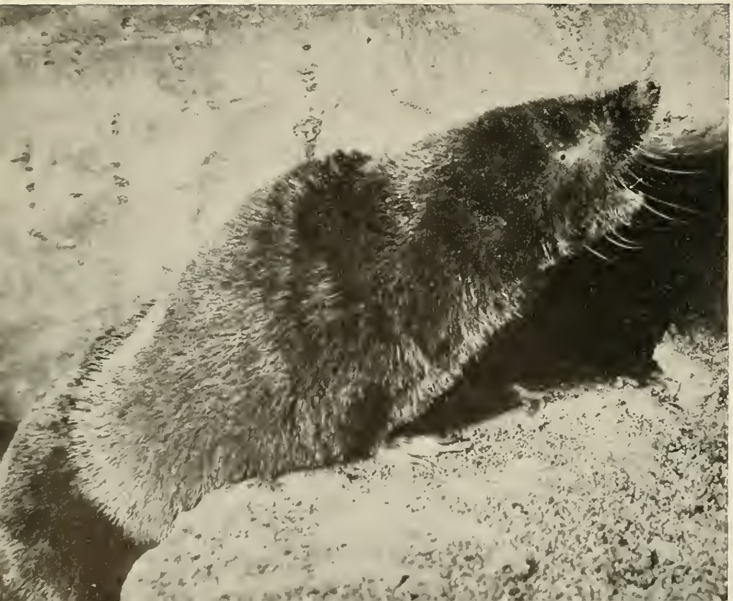
But those beliefs were soon put in the class of quaint folklore; and when the science of bacteriology was born, it was said that shrews were no more poisonous than a common house mouse—the danger was simply from infection. But this reasoning broke down in 1889.

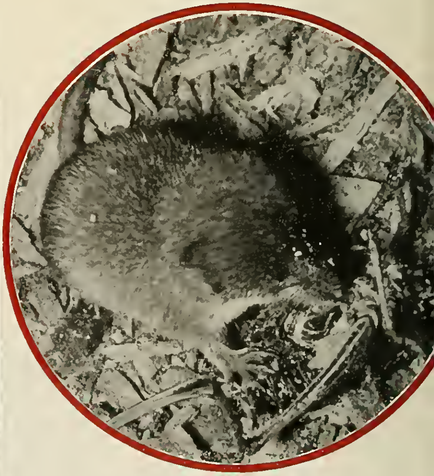
In that year a Mr. C. J. Maynard was accidentally bitten by a shrew. The skin on his fingers was punctured scarcely enough to draw blood, yet within 30 seconds a burning sensation shot up his arm and the area began to swell rapidly. Shooting pains lasted for a week, and the swelling did not go down for nearly two weeks. Here was something quicker than bacteria!

After hearing what happened to Maynard, Dr. Oliver Pearson got busy on the case. In the salivary gland of the short-tailed shrew he found a unique type of granule. When he injected saliva from this gland into mice he found it to be quite poisonous. It quickly brought on paralysis in the hind legs, labored breathing, and bulging eyes. The mice died in as little as three minutes, in a series of violent convulsions. The effects of this venom show that it is quite similar to the nerve poison of the deadly cobra. The glands of a single shrew have enough doses of it to kill 200 mice!

The shrew knows just how to use it to best advantage: Observers have noted how the short-tailed shrew bites mice through the skull—the very place where a nerve poison could act most rapidly. If the poison does not kill the mouse, it will render it so sluggish that the shrew has the upper hand in any battle.

▼ The short-tailed shrew (*Blarina brevicauda*) in a defensive pose. So rapid were the animal's movements that the picture had to be taken with speedlight, at about 1/10,000 of a second





▲ The victim: a field mouse, destructive to farm crops, short-tailed shrews help to reduce high numbers of these animals

This midget of the grass roots then turns out to be quite a package of dynamite. It is a beast with a bite like that of a weak cobra, an appetite of as much as twice its own weight in meat each day, and the power to whip an animal three times its size.

At the same time, there is no reason to fear the shrew. You will ordinarily have difficulty in getting close to one, and many scientists have handled dozens of them without being injured in any way. Actually, they are of great benefit, because they can eat their weight in insects each day, and they keep mice in check.

The startling thing about these animals is their small size. The body of the common type is only about two inches long. And I say "common" with reason—they are all around us. You or I never see them because they scurry through small tunnels under logs or leaves. But they are there, nevertheless. In the woods and fields, right up to the very edges of the city, and even in some vacant lots, they abound wherever there is cover and food.

Food for shrews is usually snails, insects and earthworms, but it may include almost anything that moves. For their size, they are the most bloodthirsty and ferocious creatures alive; they love nothing better than using their sharp teeth on a living victim. One scientist was foolish enough to put three shrews together in the same cage. A few hours later he found only one shrew left—one shrew with a very fat stomach.

A shrew loves to dine on a mouse, even though the victim is twice his size. When he tackles a mouse, a gory drama unfolds, a battle as furious as a grizzly's attack on an elk reduced to a Tom Thumb scale.

As soon as the shrew gets the scent, he gives quick chase and seizes the mouse's tail in his teeth. The mouse tries to flee and drags the shrew along behind in cave-man style. Then the shrew makes another lunge and grabs the mouse around the belly, rolling over and over with it in a mad melee of biting. By this time the poison is slowly taking effect, and the mouse is becoming more sluggish by the minute. The exhausted prey frees itself only momentarily, for next the shrew has it by the ear and starts to munch on that tender item. Again the mouse tears loose, and again it is seized by its foe, this time in the final death struggle. The shrew's battle is won when he crunches through the skull and begins eating his dessert first—mouse brains. The whole tragedy may take as little as ten minutes.

This particular battle was watched in a cage when the two opponents were placed together, but the same thing happens in the wild. One shrew was caught in the act of chasing a field mouse through its tunnel. It unwittingly chased its prey right into a mousetrap set by a mammalogist. The trap caught the shrew by the neck and the mouse by the hips—a perfect "Exhibit A" to prove the chase.

These depredations of shrews on mice occur regularly and make the shrew a very beneficial animal. Professor W. Robert Eadie investigated the winter nests of short-tailed shrews and found that many were feeding on field mice. When the shrews were at the height of their mouse-eating activity, the field mouse population in the area dropped from 80 per acre to 12 per acre. Professor Eadie figures that shrews might have accounted for at least 14 of these mice in each acre, and he adds that circumstantial evidence points to a higher figure.

Whether it be mice or snakes, the fearlessness of a shrew is incredible. One man placed a two-foot water snake and a short-tailed shrew in the same box. The snake was quite lively when placed in the cage in the afternoon and bit at everything within reach. The next morning, streaks on the glass sides of his prison documented his efforts to escape. He was then lying on the floor exhausted, while the shrew was busy tearing out his jaw muscles.

The poison obviously aids the shrew in its never-ending search for food; for above all, this pugnacious assassin is a slave to its stomach. Very seldom does it rest. Perhaps that is why death from old age comes at but 14 months.

▲ Shrews are the smallest mammals. This common shrew (*Sorex cinereus*) weighed about as much as a five-cent piece

Egrets—
The Hard Way

By Russell Barnett Aitken

Photographs by the author

▲ Some of the older egrets were huddled like statues on the tips of the cactus-like euphorbias

What started out as a simple bird-watching trip in Natal proved to be a perilous pastime when rains trapped the author in Zulu territory

READING a newspaper in a New York taxicab is one thing, and trying it in a bouncing rickshaw in southeastern Africa is something else again.

A carved wooden bird on the big Zulu's headdress bobbed blithely as he hauled me over the cobblestones of the quay toward the Marine Parade, his skin glistening like polished leather. In a tattoo synchronized with the rollicking rhythm of a lusty barcarole, the steaming pavement resounded to the padding of his naked feet. When I recognized a few of the Kaffir words, I realized that my human horse was chanting an *isibonga* extolling the prowess of his ancestors in bygone days when bloodthirsty Zulu impis rattled the assegai against oval oxhide shields to terrorize this land.

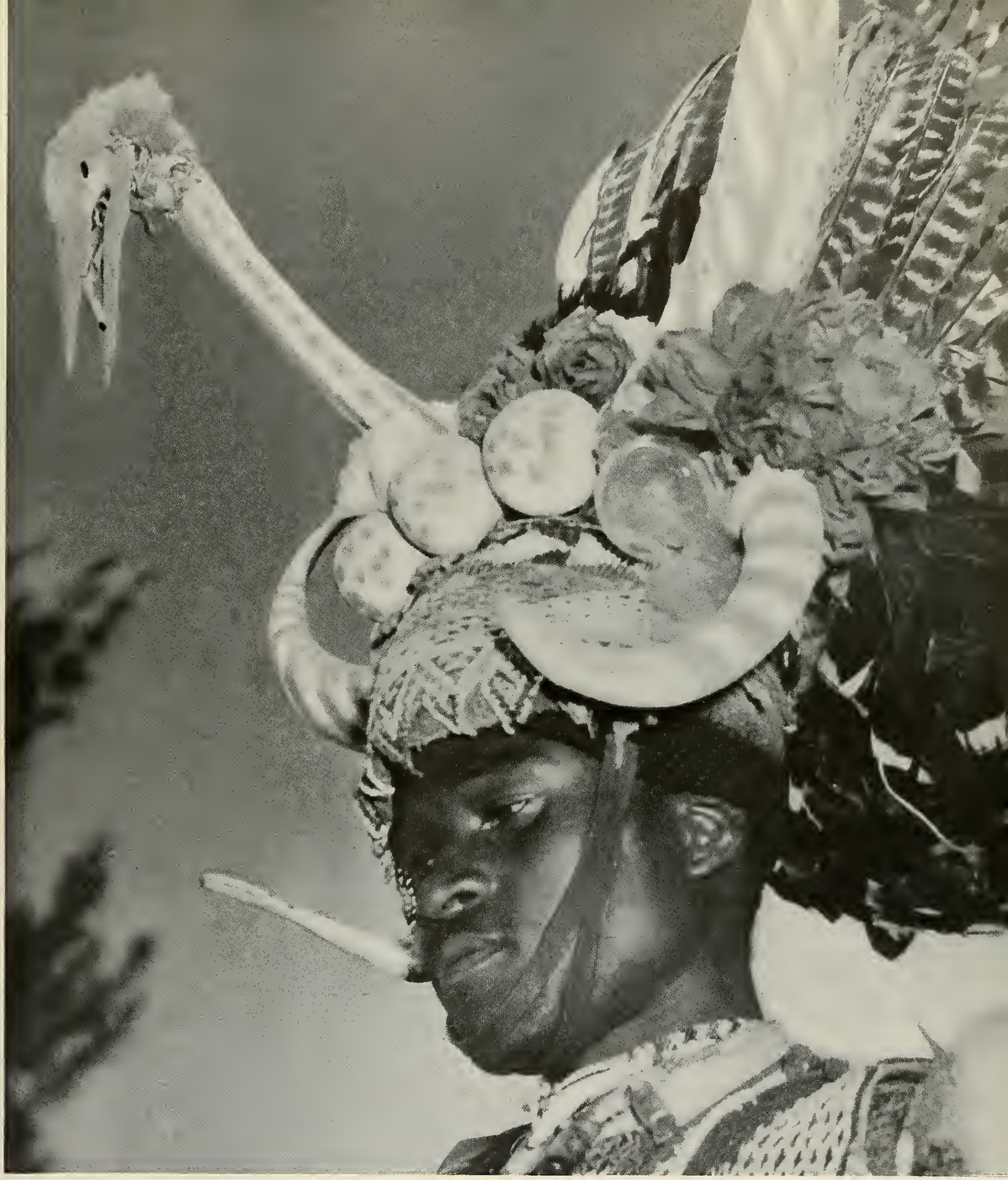
From time to time in sheer exuberance my meandering minstrel would vault high into the air between the traces in a maneuver that forced me to grab hastily for the sides as tail gate scraped asphalt. His massive shoulder muscles rippled smoothly under his exertions, and he carried himself as if supremely conscious of his physical fitness. The white man might have succeeded in breaking him to harness, but nothing could destroy the natural arrogance of a race whose warriors were famed as the fiercest in all Africa.

As we reached the Parade he leveled off to a steady jog trot without acrobatics, and I was finally able to peruse a copy of the *Natal Sunday Post* that I had purchased on the Durban pier. There wasn't much news until I turned to page 24—and that's where my troubles began.

▲ The author in egret territory. The birds decorated the trees like Christmas tree ornaments, and their chattering was incessant

Photos of egrets occupied the entire page, interspersed with shots of black-headed herons. Being incurably interested in natural history, I went on point like a bird dog. Reading carefully, I learned that the rookery was on the Umgeni River "about twenty-five miles from Durban."

This was the buff-backed egret, the ubiquitous bird that consorts

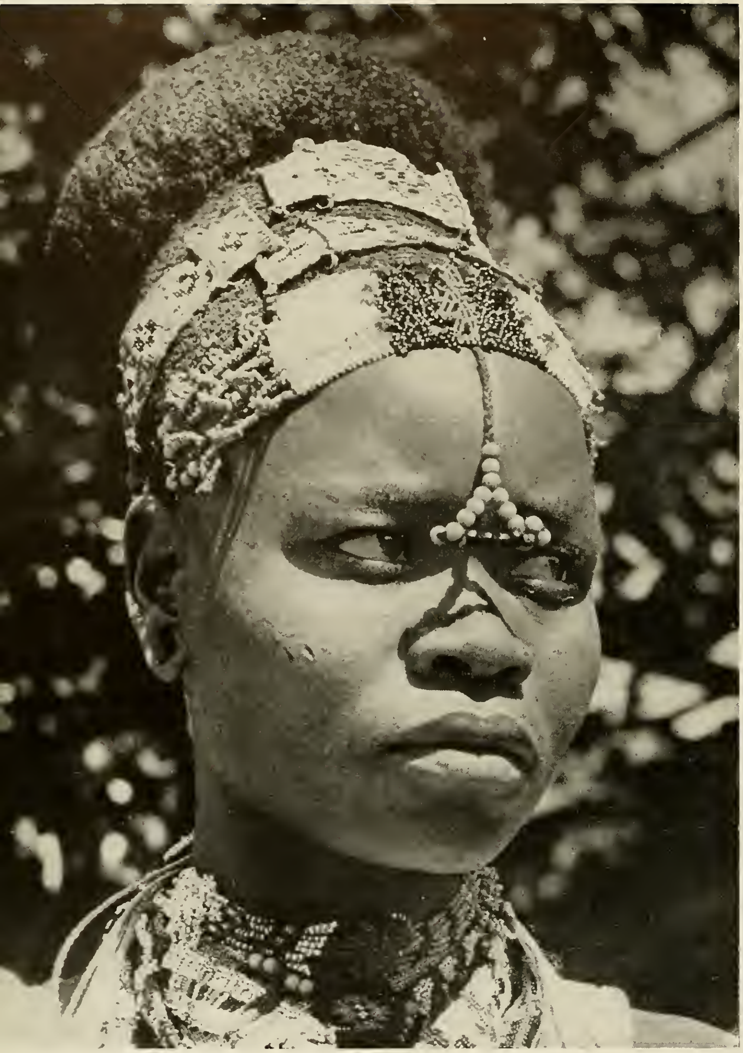


▲ THE RICKSHAW BOY's headdress was composed of beadwork, cow's horns, a carved wooden bird, and discarded light bulbs embellished with turkey feathers. Note the banded porcupine quills at the very top

with cattle, buffaloes, and elephants in order to snatch grasshoppers stirred up by the grazing animals, and hitchhikes on their backs to save exertion. The species is found throughout Africa, and in Egypt unscrupulous dragomen point it out to gullible tourists as "the sacred white ibis."

On previous expeditions I had often seen these egrets in the marshes or flying homeward in the evening in large flocks, their measured wingbeats being poetry in motion. To visit them in a rookery such as the paper described would be a rare opportunity.

The local phone book soon solved the problem of transportation, and



▲ THE ZULU GIRL who had the bearing of a princess and was as nervous as a trapped leopard

with an address scribbled on a scrap, I rickshawed to the office of a chartered cab company. A tiny woman with silver hair at the desk said that she wasn't exactly sure where the bird sanctuary was located but she would call the gazette and find out. Leaving a deposit on my hired vehicle, I left instructions for a driver to pick me up dockside at seven the next morning.

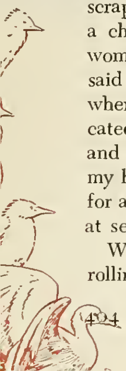
When I awakened, the boat was rolling slightly, and since it was too early for scheduled breakfast, I settled for a bit of stale toast and a cup of the strong black coffee always on tap in the big urn in the galley. Since the weather had been sultry, I wore lightweight khakis and a sun helmet, and when I walked down the gangplank and over the scattered freight piles I found the taxi waiting.

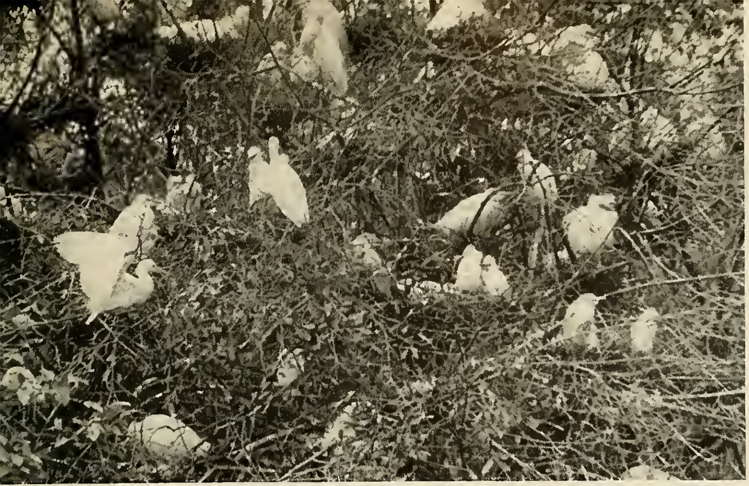
Its chauffeur proved to be the little gray-haired lady of the day before! The agency was shorthanded, she explained, and the war had been responsible for women learning many trades.

We rolled out past the Berea sandstone and into the lush green hills, past blue gums and wattle and banana plantations, and it wasn't until an hour later that I realized my driver was quite vague about our destination. We were a good 60 miles back in the hills and slightly lost when a friendly engineer told us that the birds were some 40 miles away in a different direction. He also recommended abandoning our quest, since it would entail motoring on a one-way mountain road under construction. He added a warning that the engineers would be expecting no traffic and might well crash head-on into us on a curve. His advice merely served as a stimulant to the little woman, who was evidently determined to find the birds if only to prove that she could finish what she started out to do.

Ignoring a large sign prohibiting travel on the Zulu Reservation, she plunged onto the forbidden land and soon was lost once more when the dirt road forked, unmarked. From the slope of the mountain above us came the sound of native voices blended in remarkable harmony, so we climbed toward a thatched native schoolhouse where it originated. A native in horn-rim-

▼ THE QUEST for the egrets led past peaceful Zulu kraals nestled against the slopes





◂ With 50 to 60 nests in every tree, the egrets were living like tenement dwellers. Yet beyond their half acre of slums, the euphorbias were bare of birds

▾ A distant relative, the Crowned Crane, eyes the untidy rookery of the egrets, seemingly with disgust

med glasses approached and proved to be the headmaster, a courteous chap who spoke flawless English and helped orient us. As we started back to the car, the childish treble of 50 small Zulu children rose in crescendo in magnificent music.

We found the engineer's road finally, but it cost us another hour of wandering past neat Zulu kraals, past bronzed women hoeing mealies, and fat cattle browsing. I was responsible for a short halt when I asked my pint-sized driver to stop while I stalked a Zulu maiden who was shy as any antelope on the veldt. Crouching in the high grass in ambush, I snapped her picture as she passed a great clump of devil's-daggers. At the click she bolted into the bush like a duikerbok. I called after her, "*Vela sikubone wena*" (Come forth that we may see you), but it took the woman's wiles of my driver plus the clinking of a few shillings to persuade her to emerge. With high-swept coiffure she had the bearing of a princess, accented by a headband of beadwork. Between her eyes dangled a triangle of big red and white beads, and all during the session before the camera she was nervous as a trapped leopard.

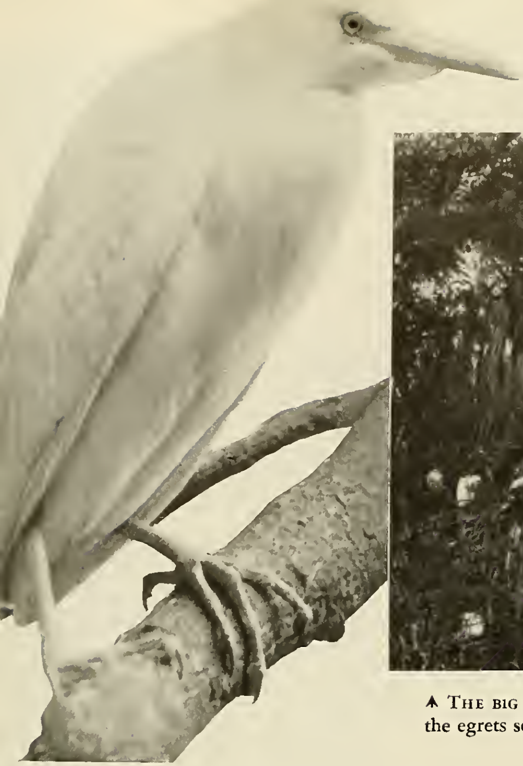
We were soon far into Zulu country, and above us purple clouds were gathering in ominous fashion. I didn't fancy their looks, but these, like the "posted" sign, were ignored by my intrepid female guide.

Just about the time we were ready to turn back, discouraged, we stumbled upon the birds, and it was a fantastic sight. The patch of euphorbia they had picked was scarcely half an acre in extent, and they dotted the cactus-like trees as if they were Christmas tree ornaments. The surrounding euphorbias were bare of birds, yet the rookery was overflowing until branches were breaking under the weight of the close-packed nests. Like tenement dwellers they had built 50 to 60 nests in every tree until it hardly seemed there could be breathing space for all the occupants. The nests themselves were haphazard affairs made of short lengths of reed or twigs placed crosswise. In one where the mother bird was absent, I saw a clutch of four pale blue eggs.

As I got out my photographic paraphernalia, a few big raindrops splashed across the windshield of the car, and I knew I wouldn't have much time. The black clouds that bunched over us promised dire things and were no help whatever for picture-taking.

As I approached the rookery the din was deafening, and it increased in volume each time I neared a nest-laden tree. The birds themselves showed little fear and none of the wariness characteristic of them when met in the bush. Consequently, I was able to see many at extremely close range. This was the buff-backed egret (*Bubulcus ibis*), which is stockier than most other herons and has a yellow bill and orange-yellow legs. The eyes and lores are pink, and during the breeding season the plumage of the head, crown, back, and breast is a rufous-buff, with the rest of the bird snowy-white except for a creamy edge on the wing coverts. Its untidy housekeeping and raucous voice coupled with the rain made serious photography difficult in the extreme.

A bedlam of boisterous birds surrounded me. Fathers were screeching to their mates, mothers clucking to their young, youngsters battling each other, and fledglings, ousted from the nests, were squalling piteously on the ground. Even as I watched one particular nest, a fledgling wobbled to the edge in a greedy effort to intercept his food-laden mother as she alighted. The rush of his brothers shoved him right off the edge to plummet 30 feet downward, where he bounced off the moss like a rubber ball. It didn't seem to injure him, and since it was impossible to climb the euphorbia, I simply placed him in a lower nest. The two



◂ **The Buff-backed Egret** is stockier than most other herons. It has a yellow bill and orange-yellow legs. The eye is pink

▴ **The big Black-headed Herons** were top dog in the rookery. They kept the egrets segregated in the lower floors of the apartment

occupants squawked and stabbed at the intruder, but even so, I decided he was safer there, unwelcome as he was, than at the mercy of hungry mongoose or genet on the ground. Above him his brothers were oblivious to his problems as they fought for a chance to delve deep into their mother's beak after food.

In another nest a brooding matron was minding her own business when a neighbor walked on her head. As soon as the foot was removed, she coiled her head like a cobra and stabbed him in the posterior with a needle-sharp beak. Her unmannerly visitor departed in haste. A group of egrets in the higher branches were playing a sort of "King of the Mountain" game, flying at a comrade on a perch to confiscate his place, only to be challenged and dispossessed themselves a moment later. Older birds were huddled like statues on the tips of the euphorbia arms, glum and solemn. A single bird to my left was ignoring all the rest; framed between two spiny arms in handsome fashion, he was disguised as a Japanese print.

The chattering white birds were held in a sort of semisegregation by the big herons. These bold black-crowned buccaneers were top dog in the roost, their roomy nests occupying the tip-top branches of the tallest euphorbias. Occasionally one or two egrets would alight furtively at the edge of the heron nests as if paying their respects, but I noticed they kept out of range of the snake-like head of the bigger bird.

The rain was pelting down now, and my driver was making frantic motions to me to finish my work. The red dirt road was slippery as I hauled my equipment back to the car, and it was only when we headed back up the mountain grade that we discovered the rain had been coming down heavily behind us all the time we had been at the Umgeni. It had reduced the road to muck. To make it worse the narrow highway was flanked by sheer drop-offs running into thousands of feet. Lacking chains, we slithered out of control toward them far too often. Several times I found myself looking past the door handle at jagged rocks far below and wishing fervently for a parachute, particularly when one vicious skid took our rear wheel half over the rim of the precipice. Around the next bend the road slanted the opposite way, and this time the skid catapulted us into the bank and into adhesive gumbo up to our hubs. No amount of coaxing would extract the vehicle from the trap, and the spinning wheels only dug deeper.

The rain by now was a torrential downpour such as only monsoons can produce, and when I stepped out to push I was soaked to the skin within ten seconds.

We were bogged down in the mountains on forbidden Zulu territory, and it was highly unlikely that anybody would come looking for us in that remote spot. My wrist-watch said five o'clock, and neither of us had eaten since early morning, my breakfast having been barely enough to keep a canary alive. We had brought no lunch, since we had hoped to make the trip in a few hours, and we had more water than we cared for. Adding insult to injury, the car had been hired by the hour, and already the cost had mounted alarmingly.

Remembering a Zulu kraal a mile back down the road, I decided to hike there to enlist some natives as pushers—an excellent scheme which failed, owing to the absence of all males. The only inhabitants, two fat Zulu matrons, accompanied me back to the car. The downpour had reduced my sun helmet to a limp toadstool affair with undulating brim, and my last few cigarettes were floating around in my pants pockets.

The Zulu women offered to help push, and we tried it. It must have made a ludicrous scene, now that I survey it in retrospect, with the wispy gray-haired lady at the wheel and me up to my knees in muck, flanked by two tribeswomen who were stark naked except for a leathern moocha, a sort of small apron, and the usual strings of beads. It was a picturesque if unsuccessful attempt at liberation.

Several other natives had arrived now to watch our little act, and one of them was an intelligent-looking youth. "Hey, John!" I yelled at him through the downpour—all Zulu men being called John by the settlers, just as all Zulu women answer to "Mary." He shuffled over. "*Inkabi?*" (Oxen?) I queried hopefully, and when he nodded his head shyly in affirmation and said that he had some at his kraal, I sent him off posthaste. When he returned an hour later, my hopes were somewhat dashed because the "oxen" proved to be heifers, scrawny ones at that.

The lad seemed so proud of his pathetic beasts that I decided to humor him. I pointed to the bogged-down car.

"*Bopelanini izinkabi zetu!*" (Hitch our oxen at once!) I ordered, and he hastened to comply, coupling them to the bumper with barbed wire and a length of rusty logging chain. Conscious of his admiring local audience, he made a big production out of it.

With the heifers ahead, grandma at the wheel, and my assorted naked comrades flanking me behind, we were ready to try again. The motor roared, the Zulus grunted, the boy yelled at his teams, but all that resulted was a wave of muck thrown over us by the spinning wheels. Then we tried it without the engine, and slowly, surely, the patient beasts, augmented by our man and womanpower, pulled the stricken vehicle from the bed of mud that had entrapped it.

It was a happy moment, except that I remembered other grades and other traps that lay ahead. We weren't out of the woods yet, and I was frankly frightened at the thought of the precipices yet in our path. With a modest amount of haggling, I quietly coerced the boy into convoying us with his yoked teams for the few remaining miles of treacherous road. Using the engine only to assist the animals on the steeper grades, we finally emerged onto the wider surfaced highway.

▼ THE BEGINNING of a bad night. The Zulu boy and his "oxen" convoyed the car to what seemed to be a safe place. But one more stretch of mud halted the expedition until the following noon

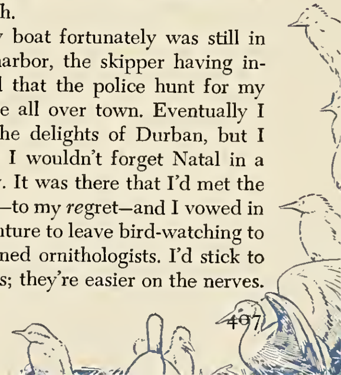
With a hasty good-by to our young rescuer, we scooted over the good road, completely forgetful of the fact that to get off the Reservation we would have to climb one more unsurfaced hill. We tried to make it ten times, our wheels spinning without traction, only to slide inexorably back down. We surrendered, finally, to huddle hopelessly in the car, wet and hungry and facing the prospect of combatting the chill mountain air. The rain was still descending in torrents.

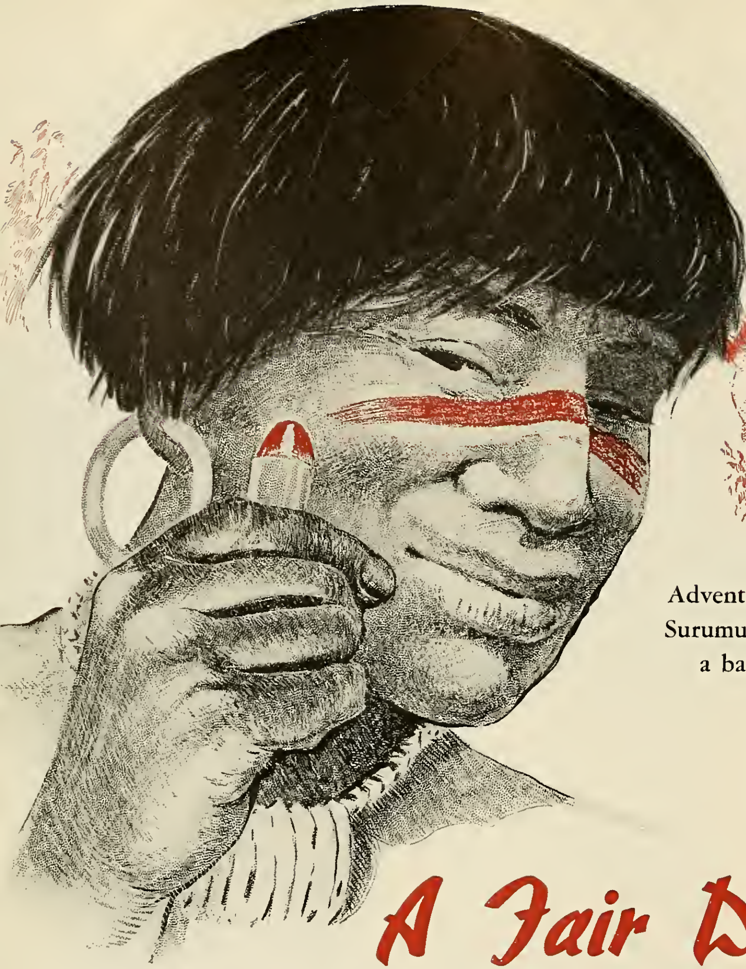
There was no glimmer of light to be seen anywhere through the wall of water, and there was nothing left to do but make the best of a bad deal. Grandma, shivering in her thin cotton dress, curled up on the front seat, while I jackknifed my long legs onto the rear cushions after removing my muck-covered boots.

All night long, when I wasn't wondering whether my ship had sailed without me, I kept thinking about T-bone steaks I had known, thick juicy ones, until I was ready to eat the upholstery. I was afraid to doze for fear of waking with pneumonia, and the clammy clothes helped keep me awake.

With the advent of daylight, Zulus began trekking past toward Botha Hill, and we sent out messages by them. It was almost noon before we got an answer from civilization in the form of a tow truck, and to complicate matters it almost slid down the hill on top of us. It took the brawn of a dozen husky natives to get us and the truck back up the slippery slope to the main highway. When we stopped at an inn for sandwiches and coffee, we wolfed the food as if we'd been marooned a month.

My boat fortunately was still in the harbor, the skipper having insisted that the police hunt for my corpse all over town. Eventually I left the delights of Durban, but I knew I wouldn't forget Natal in a hurry. It was there that I'd met the egret—to my *re*gret—and I vowed in the future to leave bird-watching to seasoned ornithologists. I'd stick to rhinos; they're easier on the nerves.





A Fair Day's Pay

Adventures in the swift waters of the Surumu and in the financial philosophy of a band of copper-colored rivermen

By GEOFFREY M. TATE
Staff Member, Archbold Expeditions, American Museum of Natural History

Lee Garnet Day Expedition Photographs

BY sheer contrast, I was reminded recently of my first experience in paying natives by means of trade goods. I had gone over to see my friend, Henry, the purser of the good ship "Pioneer Star," which brought members of the 1948 Archbold Cape York Expedition back from Australia. He was paying off the crew when I called, and I watched the money change hands as the men filed in front of his window. Everything moved and clicked like well-oiled machinery, but my thoughts skipped back through the years to the sound of native drums in a forest clearing and to a very different payoff with a fantastically incongruous currency.

Don Carter, my brother George, and I were working our way north from the Amazon River toward Roraima, that phantom mountain of many legends. We were not the first to climb the sheer cliffs protecting the flat summit of Roraima, where the ghosts of the dead Macusi and Jarecuna warriors find their happy hunting grounds, but we were the first to explore fully its cold, mist-swathed top. My little story deals with the part of our pilgrimage between a settlement called Frechal and the native village of Maloka Limaõ, in the territory of the Macusi. Frechal lies on a tributary of the Amazon called the Surumu. The rapids of this river ran with such fury that we simply were not strong enough to get through with our two canoes—a heavy one that we had brought clear up from Manaos and a light one we had purchased from the Frechal rancheiro. So George had gone ahead to Limaõ in order to send back additional Indians to help us.

It was late afternoon when the Indians reached our camp among the trees along the river. They were copper-colored, muscular, squat little men—robbers, murderers, cannibals, and worse, said the rancheiro as he hustled his family into the stockaded shelter of his home. Indeed, we knew that the reputation of the Macusi was not founded on gentleness. They looked everything that the rancheiro said they were. A few wore flapping rags of pyjama-like suits, but most were naked save for a breechcloth of dirty red cotton. They carried knives in their girdles, and each man was armed either with bow and arrows or with the *sabutana,* the blowgun. Some wore on strings around their necks the bulldog jaws of *pirai* – the deadly little fish of the rivers, which hunt in shoals and can strip the flesh off anything that swims. A few had their lower lips pierced and wore nails or sharpened bits of metal in the opening. A stripe of red paint across the bridge of the nose, from cheekbone to cheekbone, added a further touch of ferocity to countenances needing no such embellishment. Tough guys they were said to be, and tough guys they looked.

Their leader handed us a note from George. Our qualms were in no way allayed when we read it. After a short description of the river, it stated that there was much cashiri and paiwari being consumed in Limaõ and that the *tushagwa,* or chief, was drunk on it most of the time. In George's estimation, the sooner we were together again and could offer a solid front, the better. We started the next morning.

We knew from George's letter that we had four sets of rapids to traverse: the Casa Verde, the Maruai, the Providencia, and the Pedra Grande – each more difficult than the one before. However, Don and I hoped to make the trip in five days. It would have been advantageous to portage our food and equipment at the long rapids (both the Providencia and the Pedra Grande ran for over a mile), but this was partially prevented by the size and weight of the canoe we had brought from Manaos. George had purchased her, and his poetic fancy had inspired him to name her "The Pig and Wallow," slightly reminiscent, perhaps, of some country pub in England. She looked every bit her name–this queen of our little fleet. She was about 25 feet long, incredibly broad, and made of planking nearly 3 inches thick. A thatched roof had been constructed over her stern for six feet, making living quarters. Eight men were needed to paddle her in still water, more in rapids, and a whole platoon would barely have been able to lift her. So it came down to a manhandling job for the boat and a carrying operation for supplies and gear.

We started at daybreak. The Pig's crew of ten Macusi paddlers, four to a side and two at the stern, made her travel through the water at a very fair speed. Taking alternate strong and short strokes, they would tap the shafts of the heavy homemade paddles against the gunwhales of the canoe, producing a sort of rhythm that they could keep up for hours. The smaller boat had no difficulty in keeping up with The Pig, and there were no mishaps on that first day, though our thoughts were constantly with George and the alcoholic *tushagwa.*

We reached the Casa Verde rapid early the next morning. Here the river was split by a large sandstone island, and the water, compressed on each side of it, ran like a millrace. We unloaded all our movables and carried them the quarter mile up to still water. Then we returned to face the problem of The Pig and the small canoe. We had to depend upon paddle, pole, towrope, and sheer muscular force. The Macusi were like so many fish in the water,

▼ **Close teamwork** and great physical exertion were necessary to work the unwieldy "Pig" up the Surumu through its four rapids. The jungle men who did the work did not know the meaning of monetary reward

Photo by T. Donald Carter

To LIGHTEN the boats, the baggage was usually portaged up one side of the river or the other. A slip might mean a plunge into deep water and a leg torn on a jagged rock

Photos by T. Donald Carter

encouraging each other with shrill yells and shouts of *"Cai en agua"* (roughly, "get in the water and work, you so-and-so"). When one of their number would slip on the shelving, slimy rocks and skin his leg from knee to ankle, they would laugh with sadistic glee. We were all pretty well used up when we reached the head of Casa Verde rapid, but before slinging our hammocks and making camp we loaded the canoes again, ready for an early start the next morning.

For a few miles, the traveling was uneventful, though of course the farther up we went, the more powerful and difficult the obstacles became. We were determined to lose as little time as possible, not knowing how things might be with George. The second rapid, the Maruai, was a tough one and gave us warning of what we might expect at Providencia and Pedra Grande. Cliffs formed the banks of the river at Maruai, and the job of getting all our stuff up the steep bluffs to the trail was an exhausting one, not to mention carrying it for a full half mile. Then came the matter of getting The Pig and her consort up the rushing stream.

In spite of their great aquatic ability, the Macusi were constantly swept off their feet by the force of the current. When that happened, they had to cling to the sides of the boat to save themselves from being swept away. Meanwhile, those of us who remained upright, braced ourselves against the double burden of boat and men and strained every muscle and tendon to prevent the whole works from being washed down to the foot of the rapids. We finally conquered the Maruai, but one rapid like that was enough for one day. When we made camp, the Indians were as tired as Donald and I. Only Sunny, our little mascot dog, who seemed to enjoy being battered around by the torrent, had much spirit left.

The muscular, compact bodies of the Macusi seemed to glow in the light of the fire as they sat in a circle around a community stewpot, dipping their hands in and tearing and gnawing the tough beef. Tough, sullen men they certainly were, squatting on their heels in simian posture, but where could you find better rivermen?

The stars were still shining brightly when we started out the next morning, and the waning moon bathed the river and its banks in a pallid blue radiance. In the cool morning air, we felt optimistic, but when we entered the Providencia, we realized that only good luck would enable us to complete the journey in the two days that remained in our schedule.

This rapid was about a mile long, and we started our battle against it in the early afternoon. By nightfall we had worked our way up about three-quarters of its length, and we knew that we could not fight the river in the dark. So we made our boats fast fore and aft to trees on the bank, in an eddy away from the full pressure of the stream. Then we

➤ Most of the Macusi were naked except for a red breechcloth. They carried their hunting weapons with them and were a tough-looking group of men

Photo by G. H. H. Tate

cleared a small space in the underbrush and made camp there.

Heavy black clouds to the north heralded a deluge, which we knew would flood the river. A couple of days before, a cloudburst in the same direction had raised the stream four feet in one night. We felt that, while we could escape the Providencia as soon as we had light enough, the Pedra Grande, which was the worst of the four, would give us such a battle that the others would seem like child's play. George, marooned up there at Limaõ, had reported that it had taken his party nine hours to overcome it, and they had been lightly loaded. Don and I felt more than a little awed.

Rested and fresh from a night's sleep, we passed the remainder of the Providencia and reached the foot of the Pedra Grande in fairly good time. Here the river, a couple of hundred yards in width, foamed and thundered between two massive granite tors, each about a hundred feet high. We had met our Scylla and our Charybdis, and we hoped that the luck of Ulysses would be with us.

We followed the usual procedure of landing and unloading, and portaged our stores to less exciting and excited waters above the rapid. There we tethered Sunny, too, not daring to let him pit his stout heart but light weight against the whirlpools and cascades of the Surumu. Then we walked back and started the worst tussle of the lot.

The depth of the water in the Pedra Grande varied. In some places there was a bare twelve inches where the stream flowed over a shelf of rock, but the next step might take you into a pool five or six feet deep. Fortunately, there were trees scattered along the riverbank, to which ropes could be fastened. Sometimes we would expend the most stupendous effort for fifteen minutes to make secure a gain of only a few feet. Rocks jutting from the foaming water could be used to advantage as snubbing posts, but they also became deadly menaces against which the boat might crash when she slipped from our hands. There was one great thing in our favor — there was no danger from *pirai* or alligators in water as bad as that.

"Cai en agua," yelled the Indians to each other, and *"Hi capybara"* (referring to an animal famous for its swimming ability), when one of them slipped and was washed along one of the jagged stone shelves or disappeared beneath the surface to emerge 10 or 20 feet downstream.

Disaster loomed ominously close when at one point all the men supporting one side of The Pig were swept off their feet. The boat was snatched from the grip of the men on the other side and from those who were towing, and was smashed with sickening force against a sharp-edged rock. Fortunately, none of the men were hurt (no one was caught between rock and boat), and she stuck there long enough for all hands to get back on the job and bring her under control. But the poor old Pig's three-inch timbers were cracked, and a part of her heavy keel was sheered clean off. It became a personal fight; everybody cursed the current. Muscles bulged; tendons and sinews cracked. The stout poles frayed and split at the ends. A hot sun beat down, scorching the parts of our bodies that were not under water. In the distance, Sunny's excited barking lent further encouragement to us. Gradually the powerful stream lessened; the undertow swept less violently at one's feet and legs; the sharp rocks became less frequent. And then the job was done, and the mile of wild white water was passed — in six hours.

From the head of the Pedra Grande to Maloka Limaõ was only a half hour of easy paddling. We found George hale and hearty, and over his shoulder Guaracaibo and our private Peruvian Indians were grinning a welcome. Behind them was the whole population of the village, augmented by a hundred or so other Indians who had come long distances for jobs as porters. One sturdy savage, whose garb consisted almost solely of a woolen skullcap, poked a knotty thumb into his chest and said *"Inglis, Inglis,"* meaning that he had come all the way down from British Guiana. But before we could sign on porters for the overland job, we had to pay off the rivermen for getting us to Limaõ.

George had told the Chief that they would be paid on the day after our arrival. That evening, after I had issued some dried fruit to our cook and it had been stewed for a celebration supper to commemorate our reunion, the boxes containing the trade goods were opened. We constructed shelves from our collecting and specimen cases on which to spread the galaxy of wondrous things from which the Indians would make their selections. Coinage to these tribes had no value unless it was perforated and could be slung around the neck as decoration. Paper money could not even be used in that way. What was in demand was something either to comfort the inner or adorn the outer man.

Knowing this, we had laid in at Manaos a large supply of coarse cotton cloth, fishhooks and line, needles and thread, machetes, axes, nails, and such things. These were the staples, the necessities, together with salt, dried beef, and *farinha*, a gritty sort of corn meal. But we also had our luxury counters. Before leaving New York we had spent many hours and dollars browsing in Woolworth's and like places and had purchased a goodly supply of inexpensive face powder and perfume, lipsticks, combs, rubber dolls that squeaked when pinched, harmonicas, mirrors, jewelry, and a host of other things. The quantity both in luxuries and necessities was large.

All night long, across the point on which our camp was situated, we heard the beating of drums, shrill yells, and the slap-slap of dancing, naked feet. The yelling grew louder as more and more cashiri was consumed, and long before dawn we heard the feet closer to our tent and the rustling of the grass and scrub as the Macusi drew nearer to the pay office.

We breakfasted at the crack of dawn, with scores of gloomy and fantastic-looking Indians watching every mouthful and clutching bow and arrow or blowgun. We gave the *tushagwa* his personal present, a single-barreled shotgun and a handful of shells, thereby winning his approval and favor. Then Don and I drew away the cloth that concealed the array of goods, while George, with a grand gesture of his arm like a ringmaster, directed their eyes toward the shelves. We could almost hear the surge of emotion.

One point was greatly in our favor. If some especially beautiful and unusual object from America del Norte became too popular and consequently began to run short, we could set an arbitrary value. Too much or too obvious manipulation might get us an arrow in our ribs; the *tushagwa* was supposed to see that his people got a square deal, but the severity of his demands depended upon the size of his personal bonus. Indeed, he acted almost like a "civilized" person!

Although cash and currency were unknown and unwanted by the Indians, five milreis worth of trade goods per day was the established rate of payment for rivermen and porters. Other unskilled labor received less. The milrei then was valued at about 13¢, but the things we were offering as payment had incredible worth for the Macusi. The rule of supply and demand was taking its rightful place in the scheme of things.

How those things gleamed and glimmered in the early morning sunlight — rubies and emeralds in the Woolworth rings, sparkling diamonds in the necklaces, pearls in the combs, and gold in the ten-cent mirrors and compacts—things they had never imagined before! They were going to be well paid, by their standards; by ours, they had done excellent work very cheaply. There were between 30 and 40 men, each with a pay check of about 35 milreis. Each of them had about five other men, women, and children watching avidly and yelling suggestions. Nothing was done quietly.

The first things they selected were red cloth for their breechcloths, some salt, and enough of the heavy cloth to make a frock for a woman and pair of trousers or a hammock. Needles and thread to sew the material together and perhaps a machete and some fishhooks and line usually completed the list of necessities. Then the warrior and his woman shopped around among the luxuries, not even understanding the use of some of them. Mirrors and harmonicas took hold at once. The Indians got immense pleasure from making hideous faces at themselves in the one and producing awful noises on the other. So great was the demand for plain mirrors that we had to increase the value of the compacts. They had cost the same as the mirrors, but the operation was not questioned, because the compacts had two sides and were obviously worth about twice as much!

Hotter and hotter we grew as the sun climbed higher, and stronger and stronger grew the smell, altered occasionally when a bottle of virulent perfume was opened and a few

◄ **Pet birds** were among the few earthly possessions of these jungle Indians, who had lived all their lives close to nature

Photo by T. Donald Carter

▼ **George Tate** adjusting his camera for a photograph of the triumphant rivermen, while Sunny, the mascot, waits for more exciting events

Photo by T. Donald Carter

drops were spilled or applied to some copper-colored visage. Don and George acted as salesmen, pointing out the desirability of articles that were not moving well. I spent most of my time keeping Sunny and the village dogs apart. Our negotiations were conducted in the *lingua geral*, a mixture of Portuguese and Indian dialect, at the top of our respective voices so that we could hear each other above the yelping of dogs and Indians.

The lipsticks, the retractable type, were not understood at first and did not move. So George borrowed one of the women and posed her while Don did up her face. That started them going, and when one of the warriors hit on the idea of using one to freshen up his own war paint, gazing enraptured at himself in the mirror while he put a bright stripe across his nose and cheeks, a regular run on them started, and the women never had another chance. Up went the price, manipulated by us financiers, and the demand was transferred to some other article. Don, who can mimic birds and animals so naturally that they will themselves come to him, would squeeze a rubber doll and imitate the sound in such quick succession that even he became confused. This split the usually morose Indian faces into an almost amiable grin, which would have been a hearty belly-laugh in anybody else.

By the time all the Indians had been paid, and they and their brothers, fathers and mothers, sisters, cousins, and aunts had returned chattering to the village, we were exhausted and almost deafened by the babel of hoots, gurgles, grunts, screams, and quarrels that had been going on in our "bargain basement." The Brazilians and our two Peruvian Indians had prudently kept out of sight. Sunny had had about seven free-for-alls and felt that enough was enough for one day.

Later, when we came to know the Macusi and other tribes better and realized that those things, so trivial to us, were sheer golden treasure to them, we began to think it over. Certainly we had not cheated them in any way. We, too, had splashed around in the Surumu, torn off fingernails and hunks of flesh against the rough sides of The Pig, disappeared under the water, and wondered where, if ever, we would come up again. We, too, had been paid, differently, of course, but not one bit more richly. Supply and demand had taken hold, and everybody was happy.

Born Alive

By N. J. Berrill

McGill University

Ewing Galloway photo

In our world of living creatures the greatest phenomenon of all is life itself, and with every creature the aim is the same—to perpetuate its kind. Here the author discusses the course that many animals have followed to ensure this

TO be born alive, living from the living, to wake in the world with warm blood already coursing, with a hunger for milk and maternal care awaiting—this is the heart of our mammalian creation. Our company includes the elephant and the mouse and all that can boast of hair, however sparse. And all must carry the navel mark of origin from the cradle to the grave.

The dangers, the pain, and the discomforts of birth and suckling sometimes overshadow the marvelous story of how this process developed. Our ancestors gained it arduously during a million centuries. It was not always this way. Before the time of flowers and seasons, our scaled and cold-blooded ancestors laid large shell-covered eggs and hid them in the earth. In some past infinitely more remote, almost invisible eggs were scattered in astronomical numbers in the sea.

All evolving life has had a choice: to disperse a multitude or care for a few. The aim is the same: to ensure that two or three shall survive to maturity to perpetuate the race. All reproduction has this essential end—the continuity of life in a world of transient organisms. It is our own good fortune that the complexity of our nature and the time of our duration allow enjoyment of mind and senses beyond the demands of propagation alone.

A large egg gives rise to a large embryo, and one which, when hatched or born, closely resembles its parent. Both the size and the habits of the young enhance its chances of survival. The larger an egg, the more likely it will grow up into a breeding adult; but in any case the hazards are great and catastrophe the common fate. The greater the number of eggs produced, the greater the chances that a few will reach maturity. Here lies the quandary, because the production of very large numbers of large eggs is far beyond the capacity of any living organism. Only a certain proportion of growth and tissue can be set aside for the formation of reproductive cells, and some evolutionary decision must be reached —whether to divide this portion into an almost infinite number of minute eggs or into a small number of relatively large eggs, or even one or two enormous ones. One method is not necessarily better than another. It depends upon many things. Of two flat-footed mollusks, the sea hare spawns a half-billion eggs a season, the whelk no more than a few hundred, but the outcome is the same—a population struggling for sheer existence. It is the nature of things to be different, and be-

ANIMALS THAT GRAZE can usually protect iemselves from the meat eaters best by running. Young that can run soon after birth and a better chance of keeping up with the erd when in danger

➤ BEAR CUBS are born under conditions of unusual safety. The female is in her den for the winter and may not even wake up when her young are born

A HAMSTER photographed in its burow with three youngsters: a scene typical mong rodents. Rodents usually depend upon he seclusion of their den or nest to protect heir blind and helpless young

Ewing Galloway photo

Fisher photo

tween the Many and the Large lies an infinitude of compromises—scope for novelty in an adventurous universe.

Evolution is essentially a progress from one discovery to another. What is evolved for one purpose becomes useful for another, and this has been the history of living births. Marine serpulid worms possess a calcareous tube that is primarily a protection for the adult worm, enabling it to survive in otherwise dangerously exposed places. Larger species, like those of *Serpula* and *Hydroides*, take no other advantage of this tube; but the small *Spirorbis*, common on rockweed the world over, uses the tube to protect the developing young until they can crawl out as miniature replicas of the parent. Apparently small species, producing fewer eggs, have greater need to take some care of them. The large species of the slipper limpet attach their egg cases to the rock surface. Dwarf species retain them within their mantle cavity.

One thing leads to another. Egg cases protect eggs and are the first step from the abandoned millions to the coddled few. Egg cases also keep out spermatozoa, so that fertilization of the eggs is not usually possible after the cases have been formed. Fertilization within the body of the parent, generally involving some form of copulation, therefore becomes characteristic, setting the stage for living births.

It has happened again and again. Among the cartilaginous fishes, many of the sharks and some skates produce a small number of large yolky eggs, about the size of a pigeon's egg. They are fertilized within the oviduct of the mother before the case or purse is formed around them. They are attached to weed or rock by horny filaments, and after a few months the purse splits open and a small shark emerges. In the nursehound, however, and in many larger sharks, the eggs are not laid. They enter the oviducts and are fertilized there in the usual manner, but the purses secreted around them are comparatively thin and delicate. Development proceeds, and after a time the horny envelope dissolves or is thrown off and the egg and embryo lie naked in the maternal tubes, to be born alive, maybe after a few months, maybe not until nearly two years have passed. Food for growth comes from the yolk of the egg and later from a yolk-sac placenta. In some rays, nourishment comes from hairlike projections on the wall of the uterus. These are drawn into the spiracles, or breathing vents, of the embryonic ray and provide the inborn fish with a milky fluid.

One further step is possible, and this has been taken by certain nurse sharks. As the embryo develops and the yolk diminishes, flat platelike structures develop, richly supplied with blood vessels. These convey not only maternal oxygen to the embryo but all the raw materials for growth as well. A placental organ is formed, which functions like the true placenta of mammals. Thus the developing young are not merely protected by retention with-

➤ **During** the perilous period of infancy, the kid, like its mother, is a skillful rock climber. Through that talent it frequently evades attack by carnivorous animals

Ewing Galloway photo

in the mother but are for the most part actually nourished internally, to be launched finally from her body as living, lithe images of herself, with much of their growth already attained.

Living births, however, have not led to dominant careers among primitive aquatic animals as they have among the land forms. They have not produced wider freedoms or greater adaptabilities. If anything, they have restricted the range of the animal and led to greater specializations. Those creatures of the sea that are truly emancipated by being born alive, creatures that in speed and range take the oceans for their own, are the dolphins, porpoises, and whales—mammals with an epic of creation and transformation behind them.

Mammalian history is essentially a story of the land. The fishes that successfully breathed the air of the coal forest and eventually came to walk the land as reptiles had a twofold plasticity. In the course of untold generations, not only did lungs take the place of gills, and fins transform to legs, but eggs grew large and yolky, with calcareous shells enabling them to be laid on the land. With shells to be formed, fertilization had to come first. Internal fertilization and the initiation of development in the upper reaches of the oviduct became mandatory. This is the reptilian mode, and apart from the question of heat and warm blood, it is that of the birds as well. The emancipation of the egg from its need to develop in water was an epochal event in the evolution of life.

Bird photo

➤ **Walruses up for air**: a study in symmetry in a zoo pool. Full-fledged mammals despite their marine life, walruses are born alive, like whales, porpoises, and dolphins. They recognize few enemies among the other creatures of the sea, who scatter millions of eggs in the hope that a few may survive

➤ **Hummingbird egg** and ostrich egg: extremes in a method of reproduction that has long been successful. Increasingly dry climate is thought to have caused the development of drought-resistant shells on eggs that were previously soft, thus enabling them to survive out of water

A.M.N.H. photo

Ewing Galloway photo

⮝ **The hen** has become such an "egg-laying machine" that man has taken her under his protection. She lays far more eggs than are needed for survival

The first transformation, from an egg similar to a frog's to one very much like a hen's, was part of a response to environmental changes. The carboniferous forests and swamps were shrinking; the land was growing drier, with increasing exposure to light and air. The later transformation—the retention of the egg within some part of the body, with subsequent loss of the shell and yolk—was equally a response to an environmental challenge.

Early in the evolutionary rise of reptiles, the climate of the earth became colder, and about the same time the first mammal-like forms appeared. When the climate grew warm again and the reptiles reached their culmination, these mammalian progenitors took a low and humble place. They later showed that the meek could inherit the earth, but our only surviving representatives of those early egg-laying mammals are the rather specialized platypus and spiny anteater. These two have never graduated from egg-laying, but they show a solicitude for their eggs more acute than that of reptiles or even birds.

The habits of the spiny anteater are especially illuminating. It does not bury its solitary egg and leave it behind as most reptiles do. Nor does it lay it in a nest that would hold the parent to one locality. It carries the egg in folds of the pubic skin, practically a pouch, imparting to it both protection and a degree of warmth from the maternal body, without sacrifice of daily travel. Not only this, but incubation of the egg actually starts within the uterus of the mother and continues there from two to four weeks. That is, a shelled, yolky egg is retained within the parent for a considerable part of its period of development and is thereafter kept safely within a skin pouch. In a sense, the embryo is born alive, even though the egg itself is unchanged and is still the box-shell that freed the four-legged migrants from water to roam the surface of the earth. Even milk glands are already present in the mother to carry young life a little further on its journey through time. The spiny anteater's only living relative, the platypus, produces very similar eggs but lays them in a nest in an underground burrow. This custom is probably necessary as a consequence of the great amount of time the platypus spends in or under the water, for the eggs would be quickly killed by submersion.

The true pouched mammals, the marsupials, took the next step. If a developing egg remains within the uterus of the mother, a calcareous shell is an unnecessary protection. It is, if anything, an obstacle to "respiration." Thus the shell was eliminated by the marsupials. With its going, maternal nourishment through embryonic membranes became possible. Consequently, only a very minimum of egg yolk is actually necessary, and we find shell-less and virtually yolkless eggs, no more than one-sixth of a millimeter across, developing in the uterus to a stage recognizable as a mammal. When the little creature is born, it is sufficiently advanced to fumble its way to the all-essential milk of the mother.

The opossum of North and Cen-

Acme photo

▲ **Kangaroos and other pouched animals are ill-equipped to nourish the young in the mother's womb. Hence they are born in an "under-developed" condition so they can take advantage of her milk supply**

tral America is fairly typical of the marsupials. Baby opossums are born after thirteen days in the uterus. Each is about the size of a hornet. Most of the internal organs can be plainly seen through the transparent wall of the body. Yet they have to find their own way, without the help of the mother, through the forest of fur on her abdomen, into the small opening of the pouch.

Often as many as eighteen young are born at a time, with about twelve teats to support them, so that one-third—the slowest, the weakest, or the latest—are doomed from the start. The more fortunate hang on to the teats for dear life and within a week increase their weight tenfold. After two months or so, when about the size of mice, they start taking rides on their mother's back. They leave her for good when they are about three months old.

The reason why the young of these pouched animals have to get to the milk supply is that they have no special arrangement for getting nourishment in the mother's womb. At one time pouched animals overran the earth. But when other mammals developed the vascular membrane known as the placenta, the pouched mammals were swept from the scene, except for those that have taken to the trees in the Americas or found themselves in the sanctuary of water-bound Australasia. The placental mammals took the last step with regard to the close interlocking of embryo and mother. The placenta took the place of the yolk sac of earlier animals and became the organ that controls and transmits all of the necessary exchanges between the blood of the mother and the blood of the embryo. With this new invention, the period of gestation, or nourishment within the womb, could become as long as the subsequent period of suckling. In a general way the two periods are fairly well balanced for most present-day mammals, including man. The combination of uterine nourishment and suckling has placed the true mammals at the top of the pyramid of life, and man, who has made the most of this combination, is inclined to feel that the rest of the pyramid exists to support him.

Small mammals, such as rodents, usually produce litters of up to a dozen blind and helpless young. Large mammals generally produce a single offspring. There are, of course, exceptions; but most large mammals live for a good many years. They are relatively immune from attack by small ones and can readily maintain their population at this rate. Small mammals are often the prey of larger ones, especially before man and his gun upset the balance of nature; therefore, much larger numbers have been necessary for the maintenance of their kind. On the other hand, their quick maturity, incessant breeding, and rapid development can, if unchecked, lead to fantastic situations. A single pair of house rats, if allowed unlimited food, space, and safety, could give rise in only three years to 350 million, for they have large litters of nine or ten, with three to six litters each year, and they start breeding when three or four months old.

This is merely the *potential* reproduction. Natural enemies normally keep numbers in check, and the food supply finally calls a halt if nothing else does. Lemmings can breed as intensively as any rat and are less restrained. Every few years, as the numbers reach their peak, the plants on which they feed disappear under the onslaught of millions of small jaws. Then starvation, lack of space, and fouled runways set off in some manner the famous suicidal migration to the coast and a watery grave.

In all such litters, the offspring are not like identical twins, which come from a single egg. As many eggs are fertilized as there are young, and they are no more alike than brothers and sisters except that they are of the same age. The armadillo, on the other hand, produces a litter from a single egg, the members of which are identical. In the Nine-banded armadillo, the single fertilized egg gives rise to four embryos shortly after the beginning of development, so the birth of identical quadruplets is the rule and not the great exception. In the closely related Mulita armadillo, as many as twelve identical twins develop from a solitary egg.

In each of these instances, a single placenta is formed, to which the individual cords of all the embryos are attached. In ordinary multiple births like those of cats and mice, each embryo forms its own placenta. The same difference distinguishes *identical* human twins from *fraternal* twins.

Being born alive, even from a true placental mammal, can mean one of a number of things. The life that must be followed immediately after birth profoundly influences the nature of the offspring. The large grazing mammals that can escape from their enemies only by running cannot afford to have small, helpless young. The more alert the young are and the more able to run shortly after birth, the better their chances of keeping with the mother and the herd when in danger. Suckling is as necessary as ever, but the one or two offspring born to most of the hoofed mammals are as much like their fleet-footed parents as it is possible for the newly born to be. They are born large and long-legged—as large as the mother can bear. The pigs, however, are not built to develop great speed. Their answer to the problem of survival is more like that of smaller mammals, with the production of rather large litters, out of which some may survive to maturity. Their chances of survival are also increased by the fact that a wild boar or sow will put up a formidable fight to protect the young.

Ewing Galloway photo

▲ CAMELS can subsist farther from water than most of their enemies, but in a pinch the young one can keep up quite well with its long-legged mother

The largest animals of the land—the elephant, the rhinoceros, and the hippopotamus—find security in their size and their thick hides. They have little need to run. Their size and strength are also a protection to their young as long as they can keep together. But they must keep moving to keep eating, and so again we find the offspring extremely far grown at the time of birth. A single embryo develops at one time, taking eighteen months to complete its course in the rhinoceros and twenty-one months in the elephant. The calves can walk at the side of the mother virtually from the time of birth. They are already so big that only the largest carnivores can safely attack them, and the concerted action of a herd may give the calves a great deal of protection.

Such giants are exceptional. Most mammals give protection to their young until some time after weaning by keeping them in a safe lair or burrow. Breeding is usually an annual routine, either in spring or fall. While a long, slow process of gestation in the womb has its advantages, the period must not exceed a year if the annual cycle is to be maintained. Otherwise the breeding season is reduced to no more than once in two years. When paternal affections are less than the attraction of a good meal, rather difficult situations may arise. The fisher shows this very well. This fox-sized relative of the weasel is neither a fisher nor a fish-eater but

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DEATH MASKS in Lava

A forest is preserved by the same hand that destroyed it

By DOLORES BUTTERFIELD JEFFORDS

▼ PAULINA LAKE, in central Oregon, was formed after volcanic activities subsided. A portion of the Newberry crater wall is in the background. If all sections of the crater wall had remained intact, a single lake, up to 2000 feet deep, might have been formed in the crater

Oregon State Highway Commission photos

TREES have been buried alive, carbonized, petrified, and otherwise treated roughly by volcanoes throughout prehistoric ages. But it remained for a comparatively modern volcano in the Cascade Mountains of Oregon to destroy a forest while preserving in lava remarkably perfect death masks, so to speak, of the vanished trees.

Lava Cast Forest, adjacent to the Deschutes Game Refuge in Deschutes National Forest, is a creation of one of the last eruptions of Newberry Crater. This extinct volcano was discovered in 1826 and was later named for Dr. John Strong Newberry, a geologist of note, a physician, and a member of the Williamson Expedition, which explored central Oregon in 1855. Al-

▼ THIS TUNNEL marks the site where once lay a prehistoric log. When the log

though its greatest activity occurred during the Pleistocene Age, the volcano erupted spasmodically up to within the last few thousand years.

The cone of this great mountain, like that of its famous neighbor to the south, Mount Mazama, collapsed into its own crater. After the collapse, spasmodic eruptions continued, the lava pouring over the rim of the crater and down the slopes.

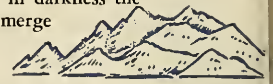
Below this vast mountain, on its northwestern slope, lies Lava Cast Forest, on a road that runs east from U. S. Highway 97, at the northern edge of the Game Refuge. Though called a forest, it is a treeless waste, a jumble of black basaltic lava, rough and broken, in the midst of which is a little geological museum. Centuries ago the forest that stood there was inundated to a height of some 20 feet by a flood of lava. The charred, dead trees disappeared, but the cooled lava retained their shape, size, and even the imprint of their bark. In an area of several square miles covered by this flow—which is superimposed upon other much older flows—there are a great number of these cylindrical lava casts, some prone, some upright, many of fragmentary length, others barely rising above the surrounding rubble—all mutely telling the story of their ancient tragedy.

Yet all about the lava wastes, and even on the forbidding ramparts of Newberry Crater itself, new vegetation is establishing itself—slowly but persistently gaining ground. It is almost as if Nature had smashed things up in an uncontrolled fit of temper and then, dismayed at the havoc and filled with contrition, had set about making amends and repairs, patiently reclothing with verdure the seared desolation. In time—whether it be centuries or millenniums—the evergreen forests will once more encircle the black slopes of the dead volcano.

was engulfed by molten lava, the wood burned away, leaving this perfect cast

▼ A SHATTERED CAST: epitaph to a one-time forest patriarch. In the background is new growth—a promise that evergreen forests may one day return to the slopes of the dead volcano

◄ THE MARMOT BOWL in winter. Beneath this blanket of deep snow the marmot village lies sleeping. After seven and a half months in darkness the animals will emerge



THE TRUE MOUNTAINEER

No one glimpsing a rare marmot in the Olympics today would dream that once they were the most playful, noisy, and sociable of wild animals in their peaceful villages above the clouds

By LOIS CRISLER

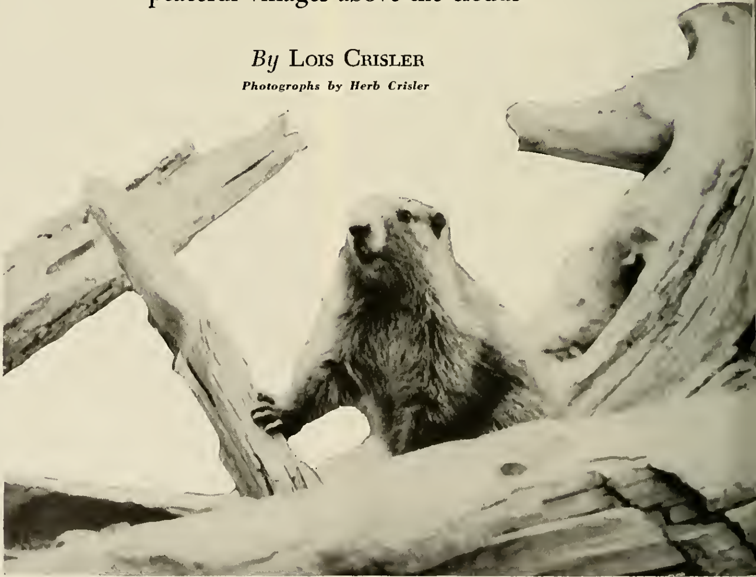
Photographs by Herb Crisler

THE marmot is less cut out to be tragic than almost any other animal. For a tragic figure I would pick a big bull elk, an antlered king, going off into the mists of death, proud and alone. Yet it is the furry, romping, wholehearted, stubby little whistling marmot who has seemed more ominously shrouded with the tragic veil.

I saw him in his golden age and did not know it. I lived with the marmot for a year in a little secluded backwater of the Olympic Mountains in Washington State and got well acquainted with him and his ways. I did not know this was only a pool left in the ebb tide of his glory. I had to learn how he lived in his golden age to feel the pathos, the strangely tragic status of this unconsciously comic little animal.

For most of a year my husband Cris and I lived alone in a lookout on the tip of a mountain more than a perpendicular mile above the salt blue Strait of Juan de Fuca. We were up in a choppy sea of mountains, with the white heads of the Olympics on three sides of us. Down from the lonely conelike tip of Hurricane, our own peak, swept alpine meadows that were a whistling metropolis of the vanishing marmot.

Cris and I, in a glass-girt lookout, were the only human beings for fifteen miles. Our neighbors were the marmots. On the rock in front of the lookout door was Molly Grumpy. Down on the lip of the drop-off into Griff Creek basin were the Twins. On the other side, on the slanting drop-off into the Marmot Bowl, we found the Babies. Then there were the *hoi polloi* of marmots, the general run, whose burrows filled the space between our favorites.



▲ "WANNA PLAY?" this marmot seems to ask. At work, the marmot is industrious, but at play his elflike, comic personality really finds expression

There were plenty of other animals around – snowshoe rabbits, deer, chipmunks, bear, even elk. Cougar crossed the mountain pass below us to the north. The coyote gave us an equally wide berth but left its cautious tracks down the ridge to the east. All these we saw at intervals.

But the marmots were property holders, with investments of labor. When we wanted to see a marmot, we had only to look out one of the 24 windows belting our 13 by 13 foot living space. When a marmot whistled, we looked too, just as the wild things did. We wanted to see who had upset the marmot—a bear, wildcat, or coyote.

The first time I began really to get acquainted with the marmots, Cris and I stood and laughed for ten minutes. Two of them were playing a game on the rounding lip of their burrow, while a third watched from the hillside above. The game was complex. It seemed to be a mixture of boxing and rolling downhill. I could not figure out which was the climax, to the marmots. The two tawny, fur-overcoated players would stand on their hind legs boxing. Then they would haul off and wait alertly for an instant, then the furry chests would fly together in a clinch. A grunt, sometimes a squeak that certainly meant, "Ouch, no fair biting," then the furry pair would tumble over and roll headlong down the side of the burrow, which was already worn bare.

To us this was the funniest part of the game—their spirit of abandonment in that headfirst, end-over-end tumble. The marmots couldn't wait to get going again. They would leap to their feet, traveling this time in normal marmot fashion, on all fours, and fly to the lip again, one ascending on each side. There they would rise on hind feet and gravely and eagerly waddle toward each other, to slap, to clinch, to make the roll all over again.

That roll, I believe, was the cream of it—a double roll and sometimes a triple; for the third marmot, which seemed to be the mother, could not resist jumping down, throwing her furry body onto the boxers, and rolling over and over with them in a reckless heap of fur down the worn hillside.

We have watched marmots coast on snow. Free movement that costs no work is fascinating to a wild animal. They have no sled, no skis. We have watched a marmot deliberately shove off and coast on its rump down the soft spring snow, or throw on the brakes when running down the snow and skid for ten feet.

Probably no adult wild animal loves a romp more than a marmot or indulges in one oftener. It was a laughing village that we watched, spread out below our lookout windows. The apparently sober-minded marmots were good for dropping work and putting on a foot race any time. If one overtook the other, they rose to box. Their supple bodies stood up slim and smooth as those of ballet dancers. They pulled high, sank low, and clinched, in a quaint pattern of movement sometimes as rhythmic as a dance.

The invitation to the dance was given by one furry paw-pat on the shoulder of a possible partner. The invitation was never scorned. The two taut, erect bodies formed a perfect arch, noses and forepaws together. Then, pushing away with their paws, each marmot curved backward, heads backward too! They swung together and their buck teeth clicked—the castenets! Then one would break away and

▾ **THE OLYMPIC MARMOTS** are the largest, weighing fifteen pounds or more. From the front, they look deceivingly bulky, but from the side, when the marmot is in motion, the body shows up skimpy and narrow

◄ A MARMOT LOOKOUT: for basking in the sun and for viewing the world roundabout. The marmot ascends rocks as easily as cats climb trees, but he grips the surface instead of clawing it

▼ PROBABLY no adult wild animal loves to romp more than a marmot. These apparently sober-minded animals are good for dropping work and putting on a foot race any time

▼ SETTING UP "SHOP" beside some marmot burrows. Hibernation begins in September, and the sleepy animals reappear sometime in May

run, hissing if the other almost caught him. Boxing or square dancing, the marmots loved it.

These marmots in the Olympics are the largest—bigger than a tomcat and weighing fifteen pounds or more. From the front the marmot looks deceivingly bulky. His hide seems to hang in folds over his shoulders, like a fur cape. But from the side, as he stalks away with his stiff-legged marmot walk, his body shows up skimpy and narrow, with neither chest nor stomach curves.

One purely marmot touch is his gait. The marmot moves fast, with quick listening pauses. After each pause he gives himself the green light by flipping his tail up over his spine—a stop-and-go signal to himself!

Marmots are rodents, big cousins of the woodchuck—not like cats, not like dogs. They ripple themselves against a rock, stroking their fur apparently with a cat's pleasure, but when they climb, it is not like a cat. They ascend craggy rocks as easily as cats climb trees, but they grip instead of clawing. All four of their black-fingered paws are as clever as little hands.

They conduct "post offices" but not as dogs do. The marmot stands up by a post and with his two long, curved, rodent upper teeth, chisels a tooth mark as high as he can reach —his letter to the next marmot. Two or three of the small gray telephone poles leading up to our lookout had been undercut by them in this way.

Most people think marmots make only one sound—the famous warning whistle. But actually they can utter most of the sounds small dogs or cats can make. They mew, growl, hiss, and bark. When a marmot finds itself hopelessly penned, with no exit, it cries like a baby.

The whistle of the marmot sounds human. A party of the Seattle Mountaineers Club were being guided across a snow field in the fog by their leader's police whistle. They became utterly confused when the marmots also began giving come-ahead or wait signals.

The marmot whistles with its whole self, like a sea gull or a bull elk. Its sloping shoulders, in the loose fur overcoat, shrug together. The whistle is for intruders. If one marmot spies an intruder at a safe distance, he whistles. Then all the marmots fly to their burrows, hind ends flopping ridiculously, and pause on the lip to look for the enemy. If he is too close, they drop out of sight without another peep. If he is a safe distance away, then one or more of the marmots, standing erect on the mound at the lip of the burrows, settle into a rhythmic series of whistles until their perturbation dies down.

But most interesting of all are the cat-and-dog discussions among themselves, when the marmots think they are alone. On two successive days Cris and I watched two marmots apparently trying to dislodge an intruder from a crevice at the back of a small platform on the side of a crag. The intruder could back into the crevice far enough so that they could not drag him out. The two whirled around, reached for him, climbed over the rocks looking for a back entrance to his hide-out, then leaped down at the front of it. The first day, the penned-in one cried. The second day it growled. From all three came a loud medley of sounds – mewing, growling, fussing.

In June, marmot life is at its peak. The village is wide-awake after hibernation, and there is plenty of juicy food in the alpine meadows. The animals work with passionate intentness, cutting hay and carrying it in long whiskery chopfuls to the burrow to reline it, dragging up damp worn winter hay from inside and dumping it off the lip of the burrow.

The marmot is a vegetarian, and he finds many a tidbit even close to the snow. He sends the earth flying up in a stream from behind his paws as he burrows for succulent roots or digs up shining white wild onions by the dozen. He stands up, holds the bulb in his "hands" to nibble off the rootlets and sometimes even to eat the onion, though he often discards it. The alpine flowers that are spread to the sky in fabulous gardens above timber line are also devoured by this little clown—rosy douglasia, the delicate, red-veined white miner's lettuce, and honey-hearted mountain phlox. His chops work with feverish speed. He stands up to grip the blue lupine spikes and pull them to him to eat. He nibbles lichens off the sun-facing rocks.

▲ HOME of the true mountaineer: the Olympic Mountains. Here, above timber line, the marmots live the year round

One of the strangest, most elfin things I ever saw was Cris playing with the wild marmots one June evening. For two weeks he had done nothing but film marmots, from breakfast or before till the late afternoon sunlight was too dim for color movies. The Twins were his standby. They got to know him.

The sun was near setting, and I knew I would not be disturbing his subjects when I went to look for Cris. I heard a scrambling, a rush from the alpine fir scrub beyond the Twin's dugouts, and a low exclamation from Cris. I could not see a thing. Then the soft rush again, a half-voiced marmot squeak, a grunt from Cris, and into the shadowy circlet of meadow they came, none of them knowing I was around. I stood still. All three were chasing each other. It looked like the good old marmot game of tag, varied into hide-and-seek. Cris jumped to one side, the marmots darted under the scrub on the other. He made a little move toward them. They ran a foot or two farther, then turned and went pellmell toward Cris again, quartering past him more intent on each other but in some tolerant, elfin way accepting the man as part of the setup.

Marmots are peaceful. Once only we saw Molly Grumpy fight. The battle was for her property rights, and she fought hard. Naturally an animal with a burrow, grazing meadow, dodge holes, and lookout rock has a sense of property. In the spring, when the marmots first come out of hibernation, grazing boundaries have to be established, and there are a few intense battles, like that of Molly whipping out a greedy intruder.

Molly Grumpy spent hours on her favorite rock near our own door. When she let me walk right past her without dropping out of sight, I felt as pleased as if I had made an A on examinations. She relaxed onto the top of the rock, flattening her body over it like a small tawny fur rug. But she had her limit of toleration. If I let water hiss on the hot stove or clattered a pan in the vast silence of the lonely mountaintop, she whirled around abruptly and directed her attention to me.

On cold windy days, she might sit hunched like a cat for an hour at a time. Poor days for relaxing out-of-doors, I thought. But on these days she thrilled me. The small blunt triangle of her head was reared against the vast blue triangle of Mt. Angeles. Mists fumed up white from the canyon below and drove past her. Her short fur blew up backward along her spine from the wind off the Pacific—an indomitable little mountaineer whom rough weather never drove "downstairs." Above timber line was her home, twelve months of the year.

In the winter when I skied down into the Marmot Bowl and stood silent on my skis, it gave me an uncanny feeling to realize that beneath my feet were these living animals. Around me was the barren, bitter beauty of mountain winter. The unbroken snow rolled deep over the burrows. There was a fine glitter in the air from sparkles of snow blowing off the cornices along the mountain ridges.

Our own winter at the lookout was lonely. Three impossible sounds were a rooster crowing, an automobile horn, the knock of a human being at our storm door. Winter was dramatic. It was a fight. Spring was the difficult time, for spring was monotonous. It never came. I was tensed to endure the winter, but then I wanted change. Yet still the storms came, the winds blew, the clouds that in winter had preferred to pile out over the strait now hugged the mountain ranges, and through their torn places I looked down with wistful longing at the rich green, 4000 feet below. Down there it was warm. Down there the sun shone and gardens were starting.

But up in our thin, lonely world of blue and white we one day had one of the dramatic experiences of our lives. We saw the marmots dehibernate.

Cris was on night duty. I went off at 1:00 A. M. and usually slept till 9:30. But on the eighth of May, Cris could not wait for me to awaken. He came down to the bedroom, which was in a shed below the lookout. He is a very soft-spoken man, but now there was excited pleasure in his every move as he said casually, "We got company."

From fast asleep I sat up wide-awake: "Who? Where?" He smiled a little and pointed out the window. Down on the white expanse of the marmot meadow were round black holes. Near each hole sat one or two dopey little dark figures. The marmots were out!

Cris told me that the holes had been there when it first began to get light. The little beasts had dug themselves out between evening and dawn, presumably because this was the first warm night of spring. We kept our eyes on those dopey little figures as we got breakfast and ate. They hopped around a little, changed position, and even moved

▼ Socializing in the sun. Marmots can utter most of the sounds that small cats and dogs can make. They mew, growl, hiss, and bark; and when hopelessly trapped they cry like a baby

➤ A MARMOT HALTS for warning sounds. His gait is fast, with quick listening pauses, after which he gives himself the green light by flipping his tail over his spine

▼ BOXING, marmot style. They pull high, sink low, and clinch, in a quaint pattern of movement sometimes as rhythmic as a dance

to the other side of the burrow. But mostly they just sat as if drugged. About 10:00 A. M., they went in and did not reappear till the next day. We went down to investigate the holes. We estimated that in one place the marmots had dug up through ten feet of snow.

These marmots had last appeared the previous fall, on September 26, when the mountain meadow was still hot and sunny but devoid of moisture. Every juicy green blade had been stripped by grasshoppers or had dried up. For over seven and a half months these marmots had not been seen by human eyes.

It was a day or two more before the marmots in deep-snowed Griff Creek basin, just below us to the north, came out, and before Molly Grumpy emerged from her den beneath her lookout rock. Daily the black circles of the holes widened, the snow level sank. But on May 18, I could still dangle my ski pole by the strap, with my wrist at snow level, and the point barely touched ground down inside the perpendicular snow funnel. Four feet eight inches!

Only gradually did the marmots come to life. But after a few days they were briskly establishing snow trails—up from Griff Creek basin through a gap they made in the cornice, to reach some early meadow grazing on the south side of the lookout, and from each burrow to reach their own favorite resting lookouts and dodge holes. The snow trails coincided with the permanent trails now thawing and coming to light, worn four inches wide among the tufts of meadow grass.

These cheerful marmot villages near our lookout were, as I say, a backwater left from their golden age. When we left the lookout and went into the interior of the Olympic wilderness, we discovered that the marmots there were in trouble. The interior of the Olympics used to be a sea of marmots. Forest lookout men shot them for sport or as targets. One claimed to have shot 300 in one summer. And still they were plentiful. Hunters shot them because they alerted the deer. We saw a marmot cheat a hawk out of a grouse by whistling the alarm just as the hawk dived. The grouse made it to cover by the down of her feathers!

But for nine successive summers now, from June to October, Cris and I have ranged beyond the trails in the interior of the Olympics. We see scores of empty marmot burrows—bushes taking root at the mouths, cobwebs across the doorways. But in a whole summer we see no more than two or three marmots in the interior. They are in desolate places where the snow lies especially late and where vegetation is not abundant. They are silent and playless. No one glimpsing a rare marmot now would dream that once they were the most playful, noisy, and sociable of wild animals, in peaceful villages above the clouds.

Villages persist near places frequented by human beings — near lookouts and ski areas. But in the interior, the last village we saw was a small one in 1945. We saw a coyote a mile away. Since then there have been no more marmots there, while coyote signs are frequent, and each summer we glimpse one or two coyotes in that territory.

What is happening to the marmots? If all the marmots in the Olympics were disappearing, one might suspect an epidemic. But they do not die out near lookouts and ski areas, which the wary coyote shuns. Probably bear, wildcat, cougar, hawks, wolves will all take a marmot if they can get him. But these are all his traditional enemies,

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and he prospered in spite of them for centuries.

I had a rare experience once. I watched a wolf hunting marmots. The marmots did all right. The wolf must have been a young one. He had utterly no strategy. He saw a meal standing bolt upright, a yellow post at the mouth of a burrow, advertising itself by whistling. It looked so permanent and so accessible that the wolf made a rush at it. Just as he neared his meal, it tumbled out of sight. The whistle was taken up from other parts. The whole marmot community was in an uproar. Meals to the right of him, meals to the left, all bidding for attention, but not a single meal to eat. The wolf rushed wildly from one to another of the widely-spaced holes till he must have been exhausted—but still hungry.

We may have seen a cougar hunting marmots once. It was in the summer of 1948, and we had discovered two marmots together in the interior of the Olympics for the first time since 1945. They were in a wild, high basin off Mt. Ferry. We saw them in July and again when we passed that way in August. In September as we came down off the snow into the basin, we were looking for our marmots when, at almost the same instant, Cris and I saw a cougar near their burrow. Apparently it had been keeping a menacing vigil by the burrow. Surprised by us, it stood with its forepaws against the rock crag near the marmot hole, its head turned over its shoulder watching us. The next minute it swallowed the mountainside with great leaps and disappeared over the sky line. Two marmots alone are very vulnerable.

In their villages, marmots are fairly safe. Their safety diminishes by geometric progression with the demise of each potential lookout, because they may have to run 100 yards or more for food. And if intercepted by a predator away from the burrow, alas—they cannot run very fast.

The first week of July, 1947, we camped near a lookout rock and den of a marmot that must have come out of hibernation quite recently. His tawny fur still carried a ragged brown band of the hibernation coat. Late-lying snow surrounded his rock and covered the slopes below it. The marmot had to run quite a distance over snow and rocks to reach a patch of vegetation on the ridge above. For the entire week we camped there, we saw him daily. Though he was silent, he was trusting. A month later we camped in the same place, but there was no sign of the marmot. There was fresh coyote spoor by the lookout rock.

The coyote is not native to the Olympics; it was first noted there in the early 1920's.

Three things we notice: the appearance of coyotes in territory new to them; the simultaneous disappearance of marmots, rabbits, and grouse; then "deadness," with neither coyote nor marmots.

Will the coyote eat himself out of the country? He ranges far and is versatile, eating grasshoppers, green huckleberries, and even their blossoms, though his flanks stick together on that famine fare. He is probably in the Olympics to stay.

Is a Government hunter the solution? The gossip behind the scenes is that with trap or poison the Government hunter first kills out every other smaller animal in the country before he gets the wily coyote. If this is the case, the remedy is certainly worse than the disease.

The October after we left the lookout, Cris and I were in the interior, beyond the trails, hurrying along a ridge above the dark blue canyon of the Hoh River, 4000 feet below. Clouds were low over the glaciers on the Olympus Range opposite us, and we were anxious to get out of the mountains. We saw a marmot, erect on the sky-line ridge ahead of us. He was watching us but in silence, motionless. There was something strangely pitiful about him, and I could not tell what it was. Surely, I thought, his companions must already have gone into hibernation. This one must be late; he will "go in" shortly. But there were no used holes near by. He was silent, alone. He seemed to be traveling.

NATURE'S Record Fasters

Nature's champion fasters make a reducing diet look like a feast

By Frank W. Lane

I'VE undergone three fasts in my life—one of fifteen, another of nineteen, and a third of thirty-two days. Generally I existed on fruit and vegetable juices diluted in water, but during the longest fast I lived for a fortnight on water only. At the end of the 32 days I had lost 27 of my original 130-odd pounds. Incidentally, at no time was I confined to bed, and during most of the time I was able to go out for walks.

After these experiences of fasting I thought I knew something about the subject, but I have since learned that, compared with some of Nature's champion fasters, I hardly know what the word means. My fast was, at most, only partial (I had water and nourishing juices) and was reckoned in days. There are some creatures of the wild whose periods of fasting are reckoned in years, and during that time they don't even have a sip of water—let alone a drop of carrot or grape juice!

Here it is necessary to deal with the extravagant stories that occasionally crop up concerning frogs and toads that are said to be found by workmen while demolishing old buildings. The heading of one such account in front of me now reads: "Toad Set in Concrete 20 Years Ago Rolls Out, Alive and Well." Another newspaper report I have seen alleges that a frog was found in a 60-year-old brick wall. The workmen declared that they could see no way for the frog to have gotten there unless it had been there when the wall was erected.

I say without hesitation that all reports of toads or frogs living for 60, 20, or any number of years entombed in ancient buildings, concrete blocks, brick walls, or what have you, are untrue. Experimental biologists know how difficult it is to keep frogs and toads alive in captivity even under the best laboratory conditions. A constant source of moisture is vital to keep them alive. In dry air they die in a few hours. How impossible, then, would it be for them to live for years (not to mention decades) under the unnatural conditions of incarceration in some impermeable substance from which water, food, and air were excluded!

If reinforcement of these arguments were necessary, it is provided by the experiments carried out as long ago as 1825 by the Rev. W. Buckland, Professor of Geology and Mineralogy at Oxford, England. He procured a dozen boxes of sandstone fitted with airtight glass covers, and an equal number made of limestone. Each box was provided with a toad, and then all were buried under three feet of earth.

Thirteen months later the boxes were dug up. All the toads in the sandstone boxes were quite dead. In the porous limestone boxes a few toads were still alive. The surviving toads were again buried, but before the end of the second year they were all dead. As the result of these and other experiments involving wood, the Rev. W. Buckland concluded: "There is a want of sufficiently minute and accurate observation in those so frequently recorded cases where toads are said to be found alive within blocks of stone and wood, in cavities that had no communication whatever with the external air."

How, then, is the persistence of the myth of the "walled-up" frog and toad to be accounted for? Doris M. Cochran of the U.S. National Museum, who has made a study of this subject, explains that these creatures, especially toads, can and do persistently hide in small holes and crevices. To a toad roaming about at dusk, the bottom of a deep excavation has no doubt often seemed an ideal spot. The summer's heat and dryness has probably often driven toads and frogs to burrow into chinks under old walls or to wander down the entrance of mines into the dark, cool, and moist surroundings—conditions imperatively necessary to an amphibian's existence.

And when the poor creature is found by a none-too-critical workman, and the story is written up by an all-too-credulous reporter, there is another entombed toad story to titillate the fancy of the newspaper reader and bring an amused smile (if nothing worse) to the face of the professional zoologist.

But now for the *real* experts in fasting. The Natural History Museum in Kensington (London, England) once had on exhibit, securely gummed to a metal tablet, an

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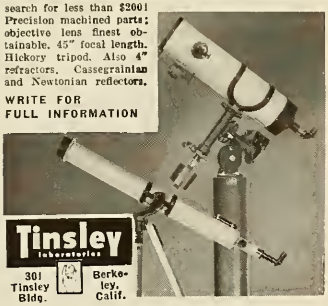

Egyptian desert snail. In its natural habitat, this snail is accustomed to lying dormant for long periods, waiting for the refreshing water that will revive it, perhaps after a long interval. Conditions in an arid museum must have been enough like the Egyptian desert to keep this particular snail in a state of prolonged dormancy. But one day, in the dim recesses of whatever serves an Egyptian desert snail for a brain, obscure processes began to work. The snail woke up after an interval of almost four years (from March 25, 1846, to March 15, 1850). One of the Museum officials, peering into the snail's case, noticed that the snail had formed a new membrane over the mouth of its shell. Scarcely believing his eyes, he carefully removed the snail and put it into tepid water. After fifteen minutes the snail was moving about, and the next day it ate some cabbage. All this happened many years ago, but I was pleased to learn, after I had mentioned this story in a broadcast, that a descendant of the man responsible for recording the incident in the scientific archives (W. Baird) wrote to the BBC confirming in general what I had said.

Another creature capable of being revived after a prolonged drought is the African lungfish. Lungfishes are also found in other countries, but it is the African species that I am concerned with here. About a yard long, and looking something like a conger eel with a flattened rear end, the lungfish lives in small streams and swamps which, under the African sun, sometimes dry up completely for months on end. That would be the end of the lungfish if it were made like an ordinary fish, but it has several anatomical peculiarities that enable it to survive prolonged drought and emerge again alive and well when the rains once more bring a watery paradise.

As the water begins to disappear, the lungfish estivates in a mud cake, in which there is a small hole connecting it to the surface and air. It breathes in and out about once every two hours. It provides its body with the small amount of sustenance necessary for its vital functions by absorbing its muscle tissue, sometimes reducing its total body weight by one half.

The lungfish preserves its body moisture because, during estivation, it is covered by a cellophane-like wrapping that is absolutely impervious to water and air and thus to evaporation. When the rains come, water runs down the air hole and enters the fish's mouth, which is the only part of its body not covered with the film. The moisture slowly awakens the fish, and by the time the rains have softened the surrounding mud, the lungfish is ready for action.

Under scientifically controlled conditions, lungfish have proved themselves able to live in their mud cakes for over four years and then be revived by moisture. Even after such a prolonged fast a lungfish will be swimming about and eating voraciously within a few hours.

Bed bugs and ticks are unlovely creatures, yet they cannot be disregarded when fasting is considered. A bed bug lives only on blood. Its beak is adapted for puncturing skin and sucking blood and for no other method of feeding. Meals may be at infrequent intervals; and for the species to continue, the bugs must be able to withstand starvation for a long time. I do not know the maximum period, but according to the publication *The Bed Bug* (His Majesty's Stationary Office, 1949) live bed bugs have been found in cubicles of a lodging house that had been vacant for three years.

In a letter to me, W. L. McAtee, formerly of the U. S. Fish and Wildlife Service, writes: "In the town where I grew up was an old soldiers' home, and it was reported that some of the inmates there had bed bugs which they had kept sealed up in bottles for various terms of years (five and ten, I recall), and I remember seeing at least one of these specimens which could still move but was practically translucent."

The habit of ticks is to wait on grass or other vegetation until a warm-blooded animal brushes past, and then to cling to it and gorge on its blood. But a tick may have to wait a long time before a suitable host comes conveniently near; and to survive such periods, the parasite must be remarkably resistant to starvation. It is. The Russian authorities on ticks, Pavlovskii and Skruinnik, have reported that one species *(Ornithodorus papillipes)* can live without food for seven and a half years. Even this may be well below the maximum for ticks, for as Ruth Crosby Noble points out in her book, *The Nature of the Beast*, J. Baron Uexküll and G. Kriszat claimed in 1934 that some ticks can live for eighteen years without eating!

Eighteen years without a meal—but it is still a long way from the maximum period that some creatures can exist without food or water. Long intervals of dormancy are possible only when the animal is thoroughly desiccated or when it has some provision for protecting itself from drying, as in the case of the lungfish with its "cellophane" wrapper or the snail with its diaphragm over the mouth of its shell. It is not so much a case of lasting without food as without water. The food requirements are reduced almost to nothing.

As far as my researches have gone, the record holders in food and water abstinence are some lowly creatures known as nematodes, a class of small worms, many of which are parasitic. It is possible that some animals even lower in the biological scale may be able to resist starvation even longer, but I am not concerned with microscopic forms here.

It has been known for many years that nematodes can live for years without eating. They sometimes go into a state of dormancy, or suspended animation, but if moistened they frequently revive. In the eighteenth century some of these worms were observed to lie dormant for 27 years and were then revived. According to Prof. Heinrich Simroth, a nematode kept in galled wheat at the Zoological Institute of the University of Leipzig revived after 28 years of dormancy. It is probable that this nematode might have remained dormant even longer, but unfortunately an overeager laboratory assistant, presumably thinking that the preserving alcohol had evaporated, poured some into the specimen jar and promptly put an end to the experiment.

This 28-year dormancy and revival stood as the record until 1945. In June of that year, two United States Government experts on nematodes, G. Steiner and Florence E. Albin, were examining the leaf of a rye seedling. On it were several nematodes in a dormant state. When these were moistened, five of them, two females and three larvae, revived. Records showed that the rye leaf had been preserved since the autumn of 1906. As nematodes are unable to move around on or in dry material, it meant that these five lowly animals had existed without food and water for nearly 39 years.

Surely 39 years is the all-time fasting record—or is it? After the surprises I have had while collecting material on Nature's fasters, I am not going to claim even *that* as the record time that any animal can resist total starvation. Zoological truth is certainly more unbelievable than the nature-faker's fiction.

BORN ALIVE

Continued from page 419

is the fastest tree traveler in the world. It mates in April, and the young are not born for almost twelve months. Whether the mother's suspicions are justifiable or not, she does not tolerate a male anywhere near her helpless babies. Within a few days after their birth, she leaves them for a night or two in April and mates again. After that she returns to her brood and nurses them through the summer as a good mother should, with the next batch already started in her womb.

Bears and bats have had their own problems and found their own solutions. Among the bats of northern countries, the embryos develop slowly in the fall and may actually stop development during the cold of the winter hibernation. While actual development requires only about three months, birth does not occur until the following May or June. At this time, the mother bats usually collect together. Each hangs by her feet and thumb hooks and spreads her leg membranes to catch the baby as it is born. During the day she hangs head-down, folding her blind, helpless sucklings to her breasts with her wings. At dusk she may fly out, taking her family with her. This can be a big load for a flying animal, for the babies may amount to more than a quarter of her own weight.

Bears generally find a den for the winter and spend much of the time asleep. They mate in early summer, and in the north the pregnant females go into a kind of twilight sleep. The cubs are born at the new year after seven or eight months' gestation. At this time, black bear cubs are blind and helpless and weigh less than half a pound. They know enough, however, to find the milk, and the mother sleeps on, possibly not even having awakened during her childbearing. Not for another 40 days do the cubs' eyes open and their teeth begin to cut, and it is spring before they can toddle out with the mother. Then for a year or more they go hunting with her, but during the second summer she takes a new mate and the youngsters acquire a stepfather. The reorganized family then travels together for about another year before the final breakup.

Birth itself is a somewhat arbitrary interruption of the course of growth, and the small size and seemingly premature birth of bear cubs is no disadvantage when compensated by the warmth, safety, maternal affection, and intelligence of the mother. This is even more strikingly shown among humans and other anthropoids, where family life has reduced infant mortality to the lowest rate for the animal kingdom.

A final contrast concerns not so much the manner and duration of life before birth, as the rate at which living material is produced. Human beings and the great whales are both mammals, with warm blood, live birth, and teats for suckling. Both carry their young for close to nine months. But one has the slowest and the other the greatest rate of growth yet known. At the end of nine months of development there is only a foot or so of human baby, and the next twenty years rarely brings a total of more than six feet. But the living substance is so organized that it may continue for a century, discover and split an atom, or create a symphony. The giant blue whale may be seventeen feet long at birth and fifty feet a half year later when it is weaned. In two or three more years it will have reached a length of seventy to eighty feet! But this blubber and brawn, shaped like a fish, lives little longer than a dog, and its fantastic rate of growth highlights the unique slowness in the forming of human protoplasm. Somewhere in the nature of this slowness lies the secret of our own humanity and the hope of our yet evolving.

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BOOKS *Continued from page 391*

A NATURAL HISTORY OF TREES

- - - - - by Donald Culross Peattie

Houghton Mifflin Co., $5.00
606 pp., 163 drawings

PROBABLY no members of the living green world have such a wide popular appeal as do trees. Although man has found it necessary to cut down and clear out forests in order to live, one of his first thoughts after building his home, paradoxically enough, is to landscape it with trees. And should man wish to learn something about the trees that he has planted, something about their range or habit, uses or history—in brief, a bit of their natural history—he should make certain that this volume by Donald Culross Peattie is available in his home library.

Actually, this is the first in a series of several volumes which will discuss all the important species of trees (no hybrids included) of our continent north of Mexico. When complete, the set will be a sort of popular edition of the classical *Silva* of Sargent. This present volume encompasses northeastern North America (comprising approximately the region east of the 100th meridian and north of the 35th parallel), an area richer in trees than any other within the boundaries proposed to be covered in the set. For each species of tree Mr. Peattie has given us a happy blending of accurate scientific description combined with a fascinating essay on its natural history. Each of these essays is in the author's delightful style, which has earned him an enviable reputation as one of our best natural historians. To make this work even more widely useful—as a manual for identification—there has been added a general key to the species of trees based on characteristics of foliage. A fine glossary and indices to both scientific (the most recent terminology is used) and English names are also present. "Gilding the lily," as it were, are the beautiful and accurate wood engravings of Paul Landacre.

If the nature lover, whether amateur or professional, can afford but a single volume on the trees of northeastern North America, then this should be it!

W. H. Hodge

THE BIRDS OF ROCKY MOUNTAIN NATIONAL PARK

- - - - - - by Fred Mallery Packard

Rocky Mountain Nature Assn., 75¢
81 pp., 17 figs., 1 map

A FEW years ago (1945, *Auk*, vol. 62, pp. 371-394), Mr. Packard published a list of the birds recorded from this region that lies in the mountains of northern Colorado. The present booklet expands and brings the list up to date, placing it in a format suitable for pocket use by visitors to the park. Not only are new records added to the list, but brief diagnostic characters of each species or subspecies are given as hints for their identification. There is a sketch map of the park region and a number of fine line cuts of a few of the birds by Roger Tory Peterson.

Mr. Packard has used care in the preparation of the list. All authentic records of past years have been consulted, together with his own observations. No sight records are accepted unless supported by a specimen taken in the park region or in the Denver or Boulder regions and unless the circumstances of observation and the competence of the observer are satisfactory. Some immediately adjacent terrain is included in the area of the list, just outside the official boundaries of the park. The notes on local distribution, as in the article in the *Auk*, give the inclusive dates of regular occurrence or, in the case of rarities, the actual dates of record.

The booklet should prove very useful for visitors to the park, who are invited to report any additions or unusual observations to the Rangers without delay, so that supporting evidence may be obtained while the bird is still in the neighborhood. With this co-operation, the list may be expanded in the future.

John T. Zimmer

LETTERS *Continued from page 386*

courses than are the other owls of the United States. It frequently feeds upon crawfish and frogs and, if an opportunity presents itself, upon fish. One naturalist found that young Barred Owls quickly learned to catch and eat live fish placed in a dish of water in their cage.

"In Africa and southern Asia there are true fishing owls. They have unfeathered legs; the claws are very sharp and have cutting edges; and the soles of the feet are covered with prickly outgrowths to aid in holding the slippery prey. These adaptations for catching fish are very much like those of the Fish Hawk or Osprey. Pel's Fishing Owl, which lives along the Congo River and elsewhere in Africa, is the finest and most powerful member of this group. According to Dr. James P. Chapin, the African natives consider this such a noble bird that only chiefs or their immediate relatives are permitted to wear its plumes as ornaments."

From a New Jersey physician:

"Recently I subscribed to your Natural History Magazine. . . . It is an exceedingly fine periodical and is enjoyed by all of us."

Ewing Galloway photo

◄ These Ground Squirrels look as if they were rooted to the ground. Ground Squirrels are burrowing rodents, which feed on nuts, seeds, corn, roots, and grubs. In their cheek pouches they transport large supplies of food to their winter holes, where they lie dormant for the season

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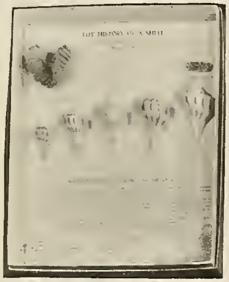
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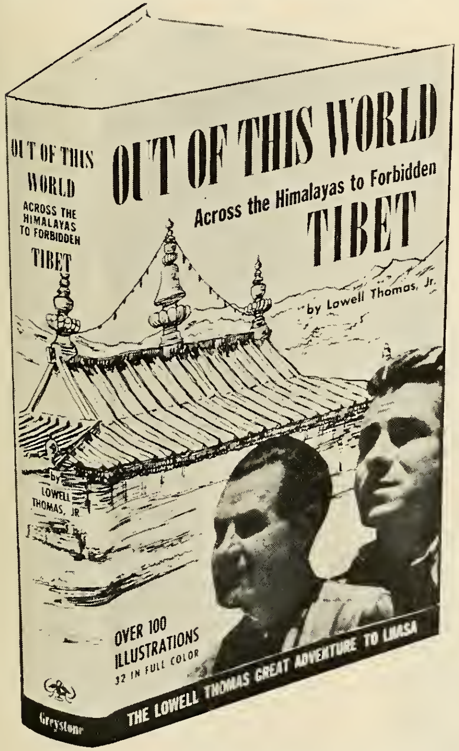

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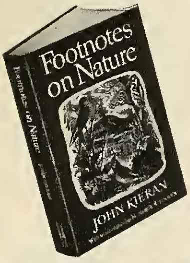

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LETTERS

Was there an Asiatic "Mayflower"?

SIRS:

Your article in the October issue of NATURAL HISTORY asking "Is American Indian Culture Asiatic?" is very interesting and quite convincing. Has anyone searched the early writings of Asiatic countries looking for records of an expedition, or expeditions, that might have carried the Asiatic culture to the Americas? If the cultures of Middle and South America, including the writing and methods of making books, was introduced from Asia, the introduction must have taken place after writing and bookmaking was developed on that continent. Consequently, a record might have been made of any expedition large enough to cross the Pacific in numbers sufficient to influence the culture of the Americas . . .

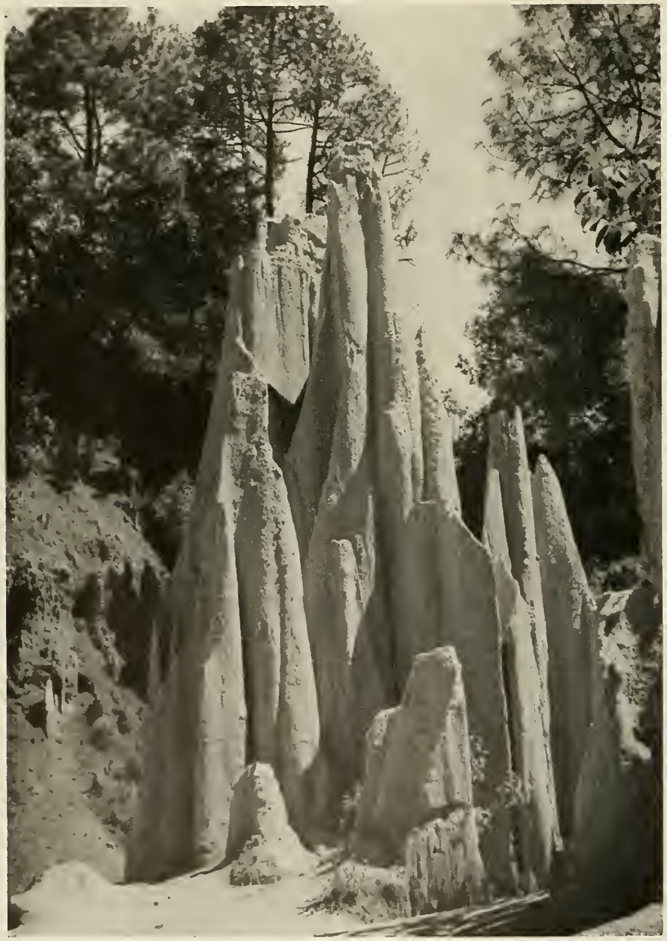
C. H. TURNER

Ozarks Chapter,
Missouri Archaelogical Society,
Springfield, Mo.

The following information is offered by Dr. Gordon F. Ekholm the author of the article referred to:

Yes, it might be worth while to search for the earliest documentary accounts of travel across the Pacific to the Americas. This would have to be done by scholars having a knowledge of the eastern Asiatic languages and of the literary sources where any such information would be found.

In Chinese annals of A.D. 499, there is an account of Fusang, an island reputed to exist in the Pacific and visited in that year by a Buddhist monk. Fusang is thought by some to have been the American continent. Other scholars believe Fusang to have been the island of Japan. The possibility that Fusang was some portion of the American continent has been proposed in a book by Edward P. Vining, *An Inglorious Columbus* (1885) and by Charles G. Leland in *Fusang, or the Discovery of America by Chinese Buddhist Priests in the 5th Century* (1875). Stefansson devotes a short chapter to this question in his *Great Adventures and Explorations* (the Dial Press, 1947).



No Termites Here

SIRS:

The accompanying photograph was taken several years ago in Guatemala, high in the mountains near Momostenango. It is not, as some may be inclined to assume, a termite nest, we are assured on good authority. It does resemble the termite nest of *Macrotermes* in Africa and the Orient. But these termites are confined to the Old World, and the details are different.

This is simply an illustration of the sculpturing power of time and weather. The soft rock has been worn down, leaving this peculiar formation, which reaches approximately 30 feet into the air. Outside of this one spot, I found nothing similar in all the surrounding territory, although there may well have been other examples.

It was said that the natives attached some special superstitious significance to this peculiarity, and that they frequently placed flat stones atop the peaks to prevent them from wearing away.

The stone is a golden yellow color and is quite beautiful against the deep blue and green of the sky and forest.

CECILIA M. EGAN

Staten Island, N. Y.

Unfertilized Eggs

SIRS:

Do birds in the wild lay unfertilized eggs as do chickens, or do they have some special instinct that causes them to lay only fertile eggs after their nesting preparations are completed? This question came up during a discussion of domestic animals, and we would appreciate any information you can offer.

GARY BRAUNER

Bronx, N. Y.

The following information is offered by Dr. Lester R. Aronson of the Amer-

Continued on page 476

NATURAL HISTORY

The Magazine of the American Museum of Natural History

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VOLUME LIX—No. 10
DECEMBER, 1950

Torch Ginger Flower..Cover Design
From a color photograph by Tad Nichols

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He lines the grocery store shelves, but do you even know whether he is full grown?

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You will find Natural History *Magazine indexed in* Readers' Guide to Periodical Literature *in your library*

THE COVER THIS MONTH

This is the red torch ginger (*Phaeomeria magnifica*)—one of the spectacular flowers that will delight the visitor to the Hawaiian Islands. It is one of the many plants of the ginger family that are found from tropical Asia throughout the warm Pacific islands. This particular species comes originally from the Sunda Islands in the Netherlands East Indies.

This is a large plant, whose leaf stems arch gracefully to a height of ten to twenty feet, with the long pointed leaves alternating in two rows up the stem. The impressive flower head you see in this color photograph is supported on a stem that may reach a height of five feet or more, separate from the leaf stalk. As can be seen in the photograph, the flower head is made up of numerous red, white-margined bracts. The basal bracts are large, waxy, and flowerless, and they form a nest for a cone-shaped head covered with smaller overlapping bracts. These are arranged spirally and are accompanied by small flowers. The cone-shaped head is about five inches long.

This picture was taken in Hilo, Hawaii, where the ginger was being used to provide a very ornamental hedgerow.

Tad Nichols

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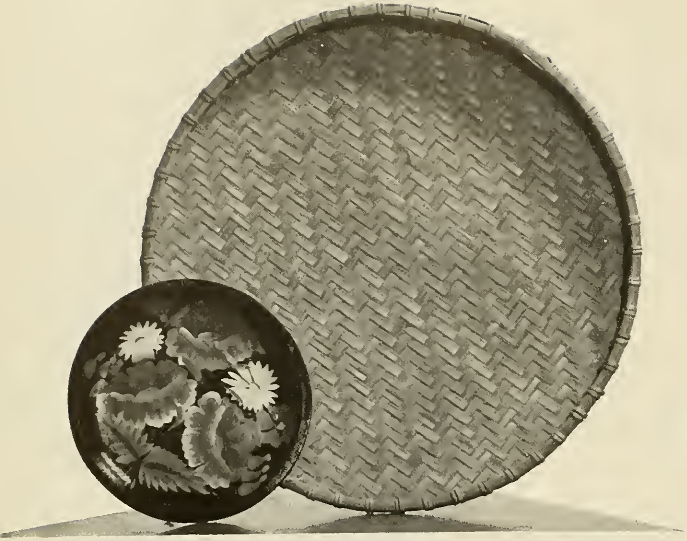

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YOUR NEW BOOKS

Kon Tiki • Menaboni's Birds

Fishes • Genetics • Time

KON TIKI

- - - - - - - - - by Thor Heyerdahl

Rand McNally and Co., $4.00
297 pp., 80 photos

READERS of NATURAL HISTORY will remember Heyerdahl's raft story,* his account of a remarkable voyage from the coast of Peru to the Marquesas Islands. The present volume, describing the trip in more detail, is so exciting and well written that it may become a classic of adventure at sea. It is excellent in so many ways that most readers and reviewers are completely unaware of the misleading and erroneous statements in the text.

Mr. Heyerdahl, convinced that the Polynesian Islands were settled from the American mainland, made the voyage to prove that it could be done. He gives the impression that there is abundant evidence in favor of his premise and that American anthropologists are too dogmatic to give him a hearing. Unfortunately, he is uninformed and misinformed on many aspects of the problem. For example, he states that the coconut palm was found in great numbers along the coast of Peru when the Spaniards arrived. Actually, Peru is outside the normal habitat of this palm. Moreover, in a land so dry that such perishable things as bean pods will survive 5000 years, not a single coconut husk, shell, or artifact made from them has ever been found.

There is evidence that people probably traveled from Peru to Polynesia in pre-Columbian times. More than 25 years ago it was shown that the sweet potato, a plant originally confined to America, had been taken to Polynesia and that the names applied to it there were of American origin. But to insist that this proves an American Indian origin for the Polynesians is somewhat comparable to claiming that they were responsible also for the populating of Ireland, because of the presence there of another American plant, *Solanum*, commonly known by a corrupted American name "potato."

There is further evidence, apparently unknown to Heyerdahl, that the Peruvians knew in considerable detail of the existence and of the position of Easter Island. It was their stories that prompted a Spanish expedition which sailed from the same port as the "Kon Tiki" 380 years previously, and, although its men did not follow instructions and missed Easter Island, they did discover the Solomons. We know, then, that there was contact between South America and Polynesia. Heyerdahl has indicated some similarities between Peruvian and Polynesian customs and legends, and we learn now that a Peruvian balsa raft can be sailed from Peru to Polynesia. But this does not add up to a conclusion that the peopling of Polynesia resulted from migrations from South America. There is more and better evidence that, basically, the peopling of the Oceanic islands resulted from movements outward from Asia.

Kon Tiki is a splendid adventure story, well worth reading. One should beware, however, of being charmed into accepting the misstatements, half truths, and poorly reasoned anthropological speculations with which it is loaded.

GORDON F. EKHOLM
JUNIUS B. BIRD

PRINCIPLES OF GENETICS

by Edmund W. Sinnott, L. C. Dunn, and Th. Dobzhansky

McGraw-Hill Book Company, $5.00
505 pages

THE "Sinnott and Dunn," first published in 1925, was for many years America's leading textbook of genetics. It dealt primarily with the essential Mendelian principles, and past editions had not quite kept up with the rapid advances in the field. The new edition of the *Principles of Genetics*, which introduces Dobzhansky as a third co-author, is thoroughly modernized. Among the many new features are three chapters on population genetics (populations, races, and species) and an up-to-date treatment of cytogenetics. Although even the latest research on bacterial genetics, biochemical genetics, and cytoplasmic genetics is dealt with, the volume has retained its character as a textbook of elementary genetics, an introduction to the field for the beginner. Over 200 illustrations help the interpretation visually. Examples from human genetics are used much more extensively than in earlier editions. The appendix contains a translation of Mendel's classical paper which laid the foundation to the whole field of genetics.

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The "Sinnott-Dunn-Dobzhansky" can be warmly recommended not only to the student of genetics but to all biologists who want to bring their knowledge of the field up to date. This includes all of us, since there is hardly a branch of natural history in which a thorough understanding of genetics is not an essential prerequisite.

E. MAYR

FISHES OF THE WESTERN NORTH ATLANTIC, VOLUME I

- - - Editor-in-Chief, John TeeVan.
Authors, Henry B. Bigelow,
William C. Schroeder, and
Isobel Pérez Farfante,

Sears Foundation for Marine Research,
$10.00,
576 pp., 106 illusts.

THIS impressive volume treats exhaustively of 70 species, 6 lancelots, 1 hagfish, 1 cyclostome, and 62 sharks. It really is a series of monographs dealing with all the species of these groups which inhabit the brackish and salt waters of the western north Atlantic, from Hudson Bay south to the Amazon. Its only competing predecessor, Jordan and Evermann's *Fishes of North and Middle America* appeared five decades ago and has long been out of date.

In breadth and thoroughness of treatment, in careful and detailed documentation, and in exhaustive record of pertinent published facts, the present series should remain unrivaled for another half century. The general plan is best illustrated by paragraph headings relating to individual species: Study Material, Distinctive Characters, Size, De-

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*June, 1948.

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scription, Color and Color Changes, Development, Habits, Abundance, Relation to Man, Range, Synonomy, and References. The latter, as well as numerous footnotes, are generously annotated.

The most significant focus in the overall picture is the emphasis on Habits, which offers a welcome summary and a firm foundation for future intensive studies, when new methods have been evolved for direct undersea observation.

The sequence of treatments affords excellent opportunities for interspecific comparisons. For example, the realization that in extremes of size among sharks a whale shark may reach a length of 60 feet or more, whereas the female Cuban triakis measures only a foot in length and yet may contain two four-inch embryos.

It seems to me that the authors have been very successful in producing a work which, in their own words, "should be useful to those in many walks of life —to those casually or vitally interested in the general phenomena of life in our waters, to the sportsman whose interests are closely associated with pleasure and relaxation, to the fisherman whose livelihood depends on the knowledge of where fish are gathered together, as well as to the amateur ichthyologist and the professional scientist."

The second part in this series is promised before many months and will deal with the rays and skates, chimeroids, and sturgeons.

William Beebe

BRITISH WADERS AND THEIR HAUNTS

- - - - - - - - - by S. Bayliss Smith

The British Book Centre, $5.25
163 pp., 84 illusts.

MR. SMITH is an enthusiastic bird photographer and a successful one, judging by the illustrations in this book, two-thirds of which are his own. The remaining photographs are by various other individuals who were successful in getting pictures of certain species that Mr. Smith to date had failed to capture with his lens. In addition to the photographs, there are three plates of excellent drawings of waders in flight, the work of Basil Lakes.

The text is predominantly narrative in form and contains much of the author's personal observation and experience in obtaining the portraits of his favorite birds. Several introductory chapters, in particular, deal with days (and nights) in the field and with the problems of bird photography. The succeeding chapters discuss the various waders in turn, giving something about their characteristic traits and their local occurrence if at all unusual. Lastly, there is a series of half-page descriptive sketches of each of the species concerned, giving the salient details of measurement, plumages, call notes, display, food, distribution, and the like. Each of these items is preceded by a key number, used for each of the species, making it easy to compare them with each other in respect to any of these factors.

The running account is very pleasantly written and devoid of technicalities, and it can be recommended to anyone who likes to read about the ways of birds and bird photographers or who enjoys interesting photographs of wildlife.

John T. Zimmer

TIME AND ITS MYSTERIES, Series III

by Henry Russell, Adolph Knopf, James T. Shotwell, George P. Luckey

New York University Press, $3.00
126 pp.

THIS book presents in published form the III series of lectures on "Time and Its Mysteries," given under the auspices of the James Arthur Foundation of New York University. The four contributions that comprise the book have been written by men of outstanding achievement and reputation in the fields of astronomy, geology, history, and watch making. The four essays are, needless to say, authoritative, yet they are written with such clarity of style as to make them readily understandable and interesting to the general reader.

Professor Russell discusses the problem of a time scale for the universe, describing four independent lines of evidence for such a time scale. These are: radioactivity, the time scale of galactic motions, the time scale for binary stars and clusters, and the life cycle of a star. From these lines of evidence he shows that the universe is going through a long history of transition—a history that extends billions of years into the past, and probably will extend billions of years into the future.

Professor Knopf is concerned with the age of the earth. He presents a clear and timely discussion of modern methods of dating the earth's age, especially by the study of radioactive elements. Nor does he neglect to consider, for supplementary evidence, such problems as erosion and the deposition of great river deltas, stratified or varved sediments, and the salinity of the oceans. From this discussion he shows that the earth must be something more than 2000 million years old, and he indicates how recent work on radioactivity has aided in the establishment of an absolute time scale for geologic history. The greatest single contribution of geology to

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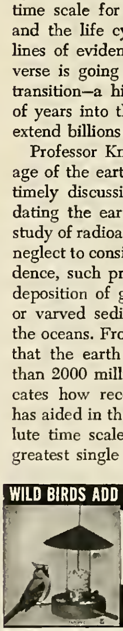

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modern thought, says Professor Knopf, is "the realization of the immense length of time."

Professor Shotwell's contribution is entitled "Time and Historical Perspective." He shows how the need for time gradually developed among primitive peoples. Then he goes on to trace the establishment of calendars by the early Egyptians and Babylonians, and from there he carries the story on to Greek and Roman history. Finally, he traces the historical perspective of time through the Middle Ages and on to our own day.

The final part of the book, by Mr. Luckey of the Hamilton Watch Company, is an interesting account of developments in portable timepieces.

This book, a worthy successor to the preceding volumes of the series, should be a valuable addition to the library of anyone interested in the subject of time. Each of the four papers that constitute the volume makes a half an hour or so of excellent reading. Moreover, this book is a useful reference volume to have within easy reach. Finally, it is beautifully printed, which makes it a nice book physically.

Edwin H. Colbert

THE PHASIAN BIRD

- - - - - - - by Henry Williamson

Little, Brown and Co., $4.00,
276 pp., 24 wood cuts

THIS is ostensibly the story of a hybrid pheasant in Norfolk, England, but the main theme is rather the rejuvenation of the run-down farm on which the bird lived. A great deal of space is devoted to agricultural practices and the activities of the people in the neighborhood, with less attention to the wildlife, including the avian hero, "Chee-kai." The bird thus occupies somewhat the rôle of a feathered Moby Dick—as much a symbol as an active character.

It is difficult, therefore, to consider the tale as a piece of true nature writing or bird biography, and perhaps this was not the author's intention. There are, in fact, a number of things that are highly dubious. Such are the incident of the goldcrest dropping to the back of a migrating owl and falling asleep during the remainder of its journey; the pheasant attracted to the scent of planted artichokes or turning its own scent inward; a ringdove so stuffed with acorns that it could not fly! It is rather for its literary flavor than for its natural history that the book should be appraised. Regrettably, many sentences are too long and involved to be altogether pleasing, while the casually introduced words of the author's invention, not to mention the Norfolk vernacular, almost call for a glossary. There are, however, many fine word pictures that give a glimpse of countryside with which the author is unquestionably familiar.

John T. Zimmer

HANDBOOK OF ATTRACTING BIRDS

- - - - by Thomas P. McElroy, Jr.
Illustrated by Lambert Guenther

Alfred A. Knopf, $2.75
163 pp., 51 illusts.

THIS highly practical guide to attracting birds is crammed with information from cover to cover. Mr. McElroy, who is Curator of the Pequot-sepos Wildlife Sanctuary in Mystic, Connecticut, has obviously gathered information both from experience and from other publications. Of the latter, the first to come to mind is *The Audubon Guide to Attracting Birds*, now out of print. The present volume lacks the colored plates and photographs of that work, but it is more terse and has more explanatory sketches. There are specific plans for building bird houses, for selecting and planting shrubs and flowers useful to birds and pleasing to the eye, and for doing many other things designed to encourage birds.

Consideration is not limited to songbirds. One chapter is concerned with the problems of managing waterfowl, and another deals with upland game birds. There are also informative chapters on the role of predators in nature, on the care of young birds, and on bird identification. Finally, there is advice on founding a municipal wildlife sanctuary, complete even to the point of supplying tentative articles of incorporation. Although intended primarily for the eastern United States, most of the information in this handbook will be applicable elsewhere.

Anyone wishing to attract and encourage birds around his home will find many valuable suggestions in this book. Even those who have been interested in this subject for years will find new ideas to try out. My wife, for example, has decided to chisel a bird bath in the top of a small granite boulder in our rock garden—McElroy says it is easy!

Dean Amadon

MENABONI'S BIRDS

- - Illustrated by Athos Menaboni
Text by Sara Menaboni

Rinehart and Co., $10.00
132 pp., 8 x 12 inches; 109 illusts.

MOST authorities, if asked to list a few of the leading painters of birds in America today, would include the name of Athos Menaboni. His work rarely appears in books and journals, though it adorns the walls of many homes, especially in Menaboni's adopted city, Atlanta, Georgia. The present sumptuous volume will make the work of this artist available to a much wider circle. Thirty-one full-page paintings of birds have been reproduced in color, for the most part excellently, and 13 more in black and white.

Continued on page 476

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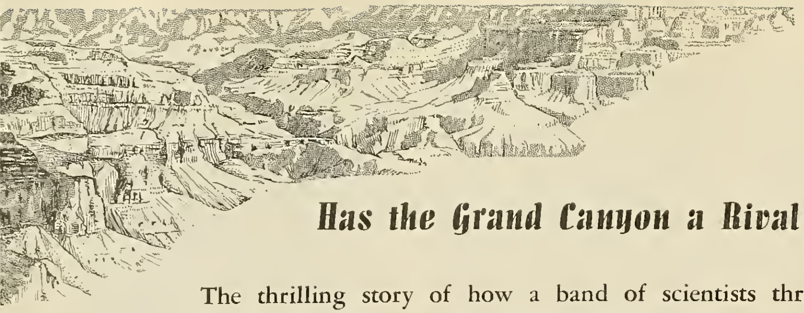
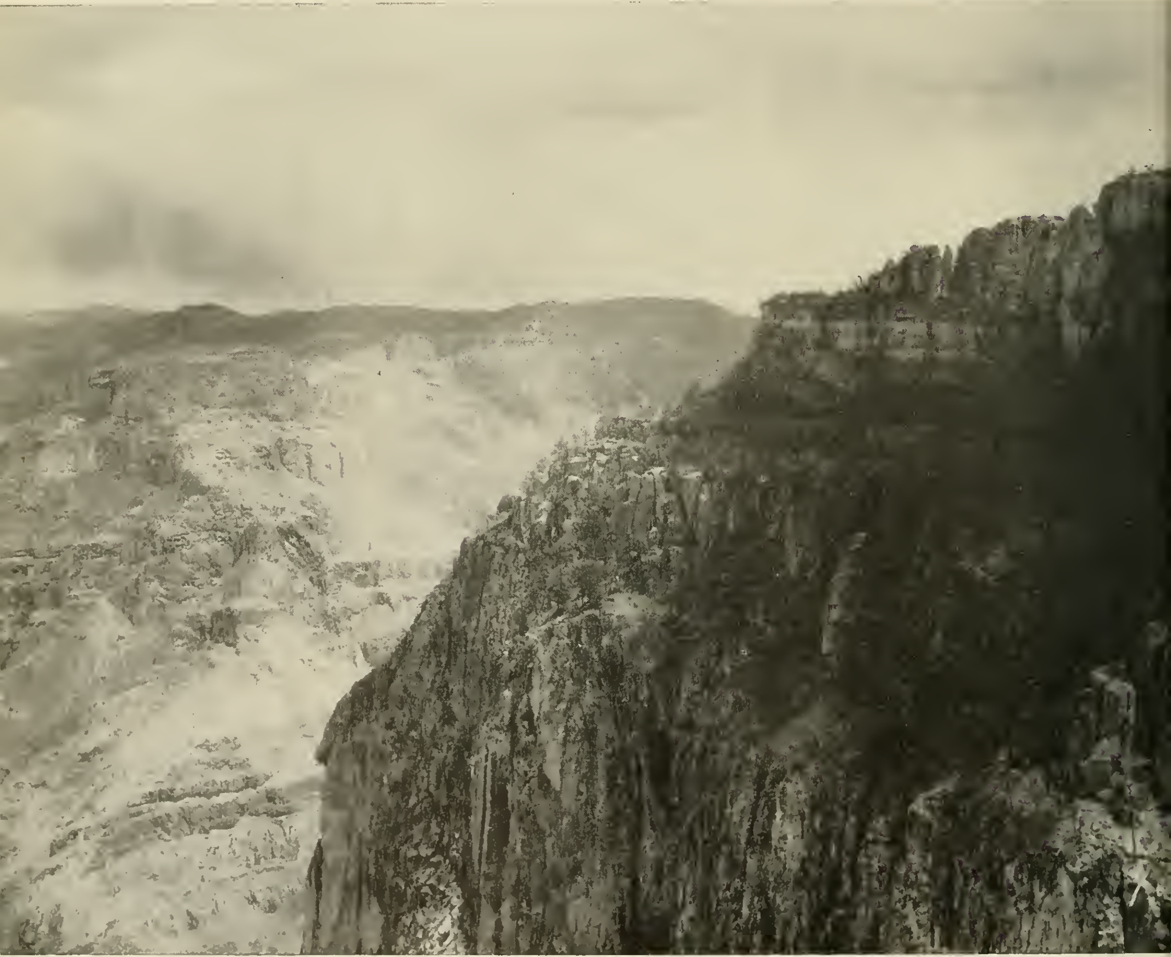


Has the Grand Canyon a Rival?

The thrilling story of how a band of scientists threaded their way for twelve days over trails known only to Tarahumare Indians to reach a gigantic canyon, reported to be deeper than the Grand Canyon of the Colorado

The



▲ A VIEW of the Barranca del Cobre from the rim. The canyon was reported to be 100 miles long, and it was so intricate in its sculpturing that the explorers sometimes found it difficult to know which was the main gorge

➤ THE EXPEDITION'S INDIAN HELPERS. *Left to right:* Pancho, Francisco, Isidro, Juan, and Chrispine, the cook

escent into the Barranca del Cobre

By ROBERT THOMAS MOORE*

Director, Zoological Laboratory, Occidental College, Los Angeles, California

All photographs by the author

Part I

FATHER Salvatierra went to the famous canyon of Hurich in 1684. "At sight of the precipice," the venerable father is quoted as saying, "such was my terror that I . . . did not precisely dismount, but let myself fall off on the side opposite the precipice, sweating and trembling all over with fright."[1]

This canyon, better known as the Barranca del Cobre, was first brought to my attention in 1933, while I was collecting zoological specimens on the Guirocoba Ranch of Jim McCarty in extreme southeastern Sonora. Jim said he had been told it was deeper than the Grand Canyon. No white man had visited it, he said, since the padre mentioned above. Curiosity prodded me to inquire about the possibilities of leading an expedition to determine its depth, to see the cliff dwellers who inhabited its caves, and, most important, to bring back a collection of birds and mammals. The area was unexplored zoologically and might contain forms new to science.

Jim tried to discourage me. He had traveled only four days toward the canyon and said it had been the most hellish journey he had taken in thirty years of mining trips! A Mayo-Tarahumare Indian he knew had told him it would take fifteen days to get there. Knowing Jim to be a rugged "desert rat," not wont to be daunted by ordinary difficulties, I asked for details.

"Wa'al," he replied, eying me coolly, "first, it's heat on the burnt-up southern foothills facing the Fuerte and the sun. We'd be in that cauldron for five days while we climb nearly 8000 feet. Furthermore, it's pig pools for water for four of those days! If that doesn't poison us, the fires the Indians set to plant their corn may block the only trail! Finally, the regular rainy season may come early before we can get back, and we can't go before May, because the Chinipas and El Fuerte may be running above their banks from melting snows in the high mountains. I've known a calf-like stream to rise 30 feet in one night from a cloudburst and put you in the trees, your bedding and food washed away!"

"Anything more?" I asked, trying to appear undaunted.

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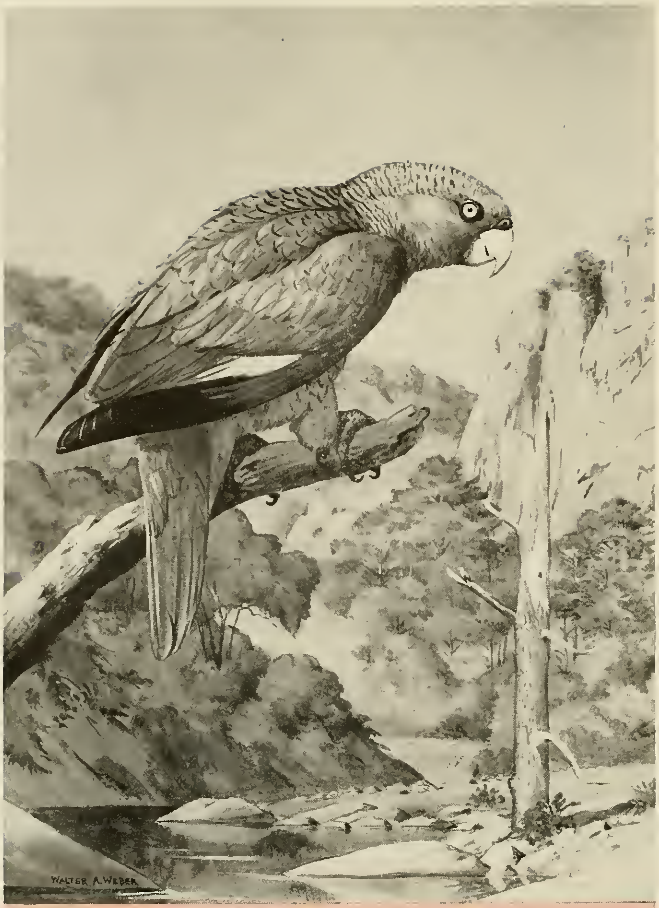
[1] Francisco Javier Allegre, *Historia de la Compañía de Jesús en Nueva España* (Mexico, 1842), Tomo III, pp. 48 and 51-52.

*ROBERT T. MOORE, one-time editor of an ornithological publication and a breeder of silver-black foxes, is a zoologist, lecturer, author, explorer, and mountain climber. He was the leader of two expeditions to southern Ecuador, during which he succeeded in ascending Mt. Sangay for the first and only time in history. He has also led eight expeditions to Mexico. On these field trips he discovered many birds and animals new to science. His vast collections of over 60,000 specimens include the world's largest assemblage of the birds of Mexico. He is the Director of the Zoological Laboratory at Occidental College, Los Angeles, and has recently presented his collections to this college. For four years he was Chairman of the Galapagos Committee and was instrumental in having a large part of this Archipelago set aside as a sanctuary for zoological life. Dr. Moore is the author of over 70 articles on zoology, breeding, and exploration and is Chairman of the group of co-authors of The First Check List of the Birds of Mexico.—ED.



▲ WOOD'S PARROT (*Amazona finschi woodi* Moore) from a painting by Walter A. Weber. The scene shows Arroyo Hondo, where the bird was discovered by the expedition

"Yes. I don't like the way Juan says he 'knows' the trail. I'll bet a dollar to a doughnut he's never seen the Barranca and he's dependin' on some sweetheart up in the Tara country to show him the way. As for the others, they may desert anytime."

"Then you're afraid to try it?" I challenged.

"Oh, no, Bob," he exclaimed with calm fire in his gray eyes. "I'll go, but you're warned!"

So here we were, a year later, chugging up to Jim's ranch door at eight in the evening, after crossing the plains from Navajoa and its glittering flame trees on as hot a day as a copper sun can create. Our party consisted of Jim, Paul Austin, Tommy Wright, our chief preparateur; Juan, five half-breed Indian *cargadores*, myself, fifteen burros, and five mules. It was on May 4 that our party clattered forth gaily on the "Caliente Trail," whose name should have warned us of the heat that was to come. The hoofbeats of our pack animals startled a large flock of Sonoran White-fronted Parrots from the feathery *sabinas* arching overhead, and they soared about in short half arcs, chattering continuously on the same note. We disregarded the heat, believing we soon would climb into a cooler region. Here, too, we saw our last flock of Magpie Jays and marveled at the grace of their cadet-blue tails, eighteen inches long, streaming across a brassy sky. Equally striking were the great Military Macaws, always in pairs, propelling themselves with powerful strokes at high altitude, while they talked to each other with raucous familiarity.

That afternoon we passed Colmoa on the Rio Fuerte and plunged into the stifling Limon Canyon, its cliffs covered with columnar *hecho* cacti and the rambling obese roots of huge wild fig trees. That night we tented at Palmar, where chachalacas filled the night with a counterpoint of harsh calls.

The next morning we passed a wooden cross stuck in a pile of rocks marking the spot where someone had been assassinated. Had we been superstitious, we might have forecast disaster, but still beauty stayed with us, defying the increasing heat. An enormous grove of *amapas* waved a golden salute; a Coppery-tailed Trogon streamed across our trail, his flashing belly blood-red in the fiery sun; and great white salvers of what Jim called "papache" flowers hung in areas of radiating fragrance. That noon we lunched at a vile-smelling spring, whose filth had lured a group of pigs to wallow in it, and then our first enemy struck without warning. Paul, parched beyond endurance but heedless of our shouts of danger, fell prone and drank. Ironically, flaming cardinals were whistling and mockingbirds were singing as if to taunt our throats, which were too dry to sing or even talk. Descending a long exposed grade to the accompaniment of the cries of vulture-like hawks, the Caracaras, we hobbled into Descanso, Sinaloa, to find a spring of PURE water near a grove of *huamuchil* trees. Our swollen throats were soon lubricated. If only Paul had waited! That night he was seized with cramps and rolled in pain. I kneaded him throughout the anxious hours, while a screech owl, the Sinaloa Vinaceous,[2] quavered a tremulous obbligato. Dogs howled, mosquitoes bit, pigs snooped, and Indians stumbled about, drunk from the *Cinco de Mayo* celebration.

In the morning Paul, though obviously weak, insisted on continuing. Jim refused to vote, saying we would reach an altitude of 1600 feet at El Orito. When I asked him if it would be cooler, he shook his head. I made the difficult decision to go forward for at least one day more.

About ten in the morning we reached La Junta, the junction of the Chinipas and El Fuerte. Pushing our way through white flowering papaches as fragrant as gardenias, we entered the swirling Chinipas above the junction. The water rose to the backs of the wobbling mules, but we got through without disaster. Sheer cliffs faced us, but we reached El Orito at 1600 feet. The altitude proved no cooler, and we crawled under a low oak to lunch.

Now it was Tommy's turn to collapse. Refusing the canned crabs, which still tasted good to Jim and me, he plunged into the dirt under a desert shrub and paid no heed to questions of concern. His old enemy malaria had struck him down. I had not known he was subject to periodic recurrences. Two hours later he insisted on continuing, so we lifted him onto the most comfortable mule we had. For the next two days he hunched in the saddle like one in a trance. Philosophy was now our only comfort. Jim and I passed it back and forth in a desperate attempt to keep up courage. Crabs still tasted good to us, but sardines were anathema to all.

On the 7th, after leaving the oaks at 1800 feet altitude, a steep, torrid climb brought us to 2300 feet in an association of mountain mahogany, papaches, and white lantana. Our throats were now parched and swollen almost beyond endurance. During the lunch hour at Cresta del Cedros, Jim looked mournfully at a slimy pool of green water at the base of a cliff, forbade us to drink it, but suddenly succumbed himself. His years of prospecting must have made him immune, for he suffered no ill effects. But the situation was getting serious. I reached into my personal bag and took out one of the cans of grapefruit juice I had reserved for this purpose. No nectar of the gods could have tasted more delectable. My other ones must be kept for the hot days ahead and the return trip through this inferno. Paul and Tom were now in a bad

▲ A NATIVE FAMILY of Tarahumares in the Vasagota Valley

◀ FROM THE CREST of the Sierra Madre Occidental at 7400 feet, the explorers looked down into the cuplike Vasagota Valley, completely rimmed by mountains way, and the heat had shaken the endurance of all. Tough old Jim maintained his cheerful attitude and sphinxlike smile. My notes that night were anything but cheerful: "Tom ill, Paul still in a bad way. We met Indians who say there are huge fires ahead! Mosquitoes and wandering burros, frightened by jaguars, make the night hellish!"

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[2] *Otus asio sinaloensis.* After the expedition's return to the States, it was described by the author as new to science (Proceedings of the Biological Society of Washington, vol. 50, p. 64).

On the morning of the eighth, Jim called me aside and admitted he was worried about the condition of the mules. He feared they could not make the 3000-foot climb up the Cresta del Tigre in the terrific heat. Further, he said that the Indians we had met had reported that the fires, set by bee-hunting Indians, had burned up the grasslands beyond the Tigre, where he had hoped the pack animals could recuperate their strength. We must buy corn as soon as possible. We decided to risk the Tigre and hope to get corn from Indians at villages above it.

El Tigre proved true to its name. Its claws were sharp rocks on the slopes of hairpin turns, which ripped our bags and unseated the loads. Halts became more frequent for adjustments, and all the pack animals were breathing heavily in the murky heat. Sweat rolled down our bodies. We were stripped to shorts. We made the top at the 4000-foot altitude and found Encino Gordo nothing but a huge fallen oak by the road and one hut on the mountainside. The occupant would not sell his corn! Our duffel bags were cut in several places and had to be repaired. They would not stand much more.

That night jaguars frightened the pack animals. As I planned for the morrow, I watched the burros hovering close to our sleeping bags, their patient faces bespeaking ages of endurance of hardships, amid cruel sunlight and dangerous darkness. Little sleep for the leader! But the predawn brought one of the loveliest songs I had ever heard, rivaling the Fox Sparrow's of the Magdalen Islands in the Gulf of St. Lawrence. It began with three rapid high-pitched notes on the same tone, followed by a dashing series, zigzagging up and down the scale, and ending with an exquisite trill of rich overtones. I guessed it to belong to McLeod's Sparrow, which I had never heard.

On this morning of the ninth, an Indian boy rushed up with news that the fires had crossed our trail ahead, burning several square miles and consuming the grass we were relying upon. At eleven o'clock we rounded a cliff and came in sight of the flames. It was a frightening prospect! The fire had cut our only possible trail, and a wind was driving the flames toward the great Cumbre de Lojito, which Juan claimed was a worse ascent than El Tigre.

Skirting the fire, we left the trail and drove our tired animals up steep rocky ridges. At last we dropped into a ravine and gulped down a hasty lunch under our first cottonwoods. Jim wanted to make

◄ Arroyo Hondo, viewed from beneath the cliff where the Stygian Owl awoke the author camp here for the night to rest the pack animals, as they would have no food above. I protested vigorously, pointing out that should the wind veer in our direction, we might be completely trapped by the flames. Fortunately Jim yielded, and we climbed a half mile higher up the ridges to a small field and hut, known as "Portreros." While we watched, the wind did change and the fire swept that ravine. Jim, Tom, and two Indians who had crept down to bathe in the pools barely escaped being asphyxiated. Our pack animals were exhausted, but they were munching the little grass available, and I reluctantly gave orders to camp.

We watched the wind drive the flames up the front of our mountain eyrie, while a thunderstorm without a drop of rain passed over our heads. Slowly the fire mounted the rocky slope. Less than an eighth of a mile away, the wind died down and the flames, having little but rocks to feed on, sputtered out. But the fire continued to burn below. By changing sentinels every hour, we tried to snatch a few moments of sleep before dawn.

On the tenth the Cumbre de Lojito proved to be everything the Indians claimed, a frightful climb of 3500 feet. Exceedingly tortuous and steep, it displayed an endless number of hairpin curves and a trail that was nothing but a bed of rocks. For a while it seemed the mules could not possibly make it, although the burros managed better. Every 200 or 300 yards the loads slipped and had to be rearranged. All the animals breathed heavily, frequently stopping and refusing to climb higher. The Indians were nimble as jack rabbits whenever a burro jumped the trail to try to turn and descend.

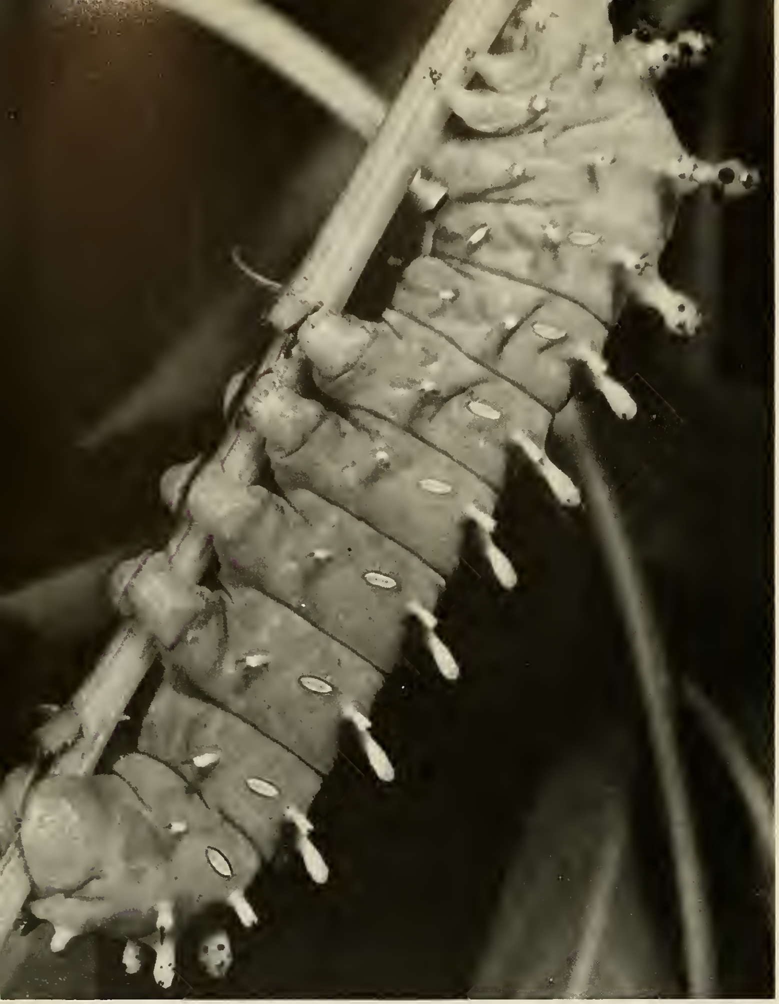
At a point nearly 6000 feet in altitude we paused and were amazed at the tremendous panorama of the entire route we had covered during the past seven days. All of southern Sonora lay at our feet, and Jim pointed out two peaks that he said were near his Guirocoba Ranch. We were among pines and oaks in the Transition Zone. We had much to be thankful for. It was cooler now, and for the first time in three days Paul and Tommy seemed more lively. Zestfully we threw ourselves prone beside mountain streams of pure water that dashed across the trail. Flower and bird life had almost completely changed; the beautiful red-barked madroño had become common.

Two hours later we reached the top of the climb at 7400 feet. Behind us curled the snaky trail of our ascent; on the other side, 1000 feet below, lay a cuplike valley completely surrounded by a mountain rim. Down the two-mile floor cascaded a wild torrent through a patch of farmland which was being worked in community by a group of Tarahumares who called their valley Vasagota. But the greatest surprise was acres of wild grass for our starved mules and burros! We immediately decided to camp for two nights to give the animals and *cargadores* a well-deserved rest. Meanwhile we would collect zoological specimens. Our first attempt was a combined hunt for a giant bat coursing at great speed over our tents. At length Tom dropped it, crying, "I've never seen anything like it!" But the most interesting sounds to me were unmistakable gobbling on the mountain walls. During the night I heard these turkeys from four different points on the rim. Hunters had reported them to be extremely large and black, but no specimen had reached the museums.

On the eleventh, Paul and I hunted turkeys from the predawn until darkness, when a rain-bombing thunderstorm forced us to find our way back through an inky night to the tents. I saw none, but Tom had encountered five without securing one. I collected several specimens of the Chihuahua Grosbeak, however, of which only one individual had ever been taken before. Hummingbirds and warblers of several species were common, and I observed two Thick-billed Parrots at close range, apparently the first record of their occurrence on the western side of the Sierra Madre.

Continued on page 473

➤ **Jim McCarty** and the turkey new to science that the author secured at Guayachi



▲ THIS CLOSE-UP shows how the oddly fashioned legs of the Cecropia caterpillar grasp onto a twig. The creature can cling to a branch so tightly that it is sometimes difficult to pry it loose

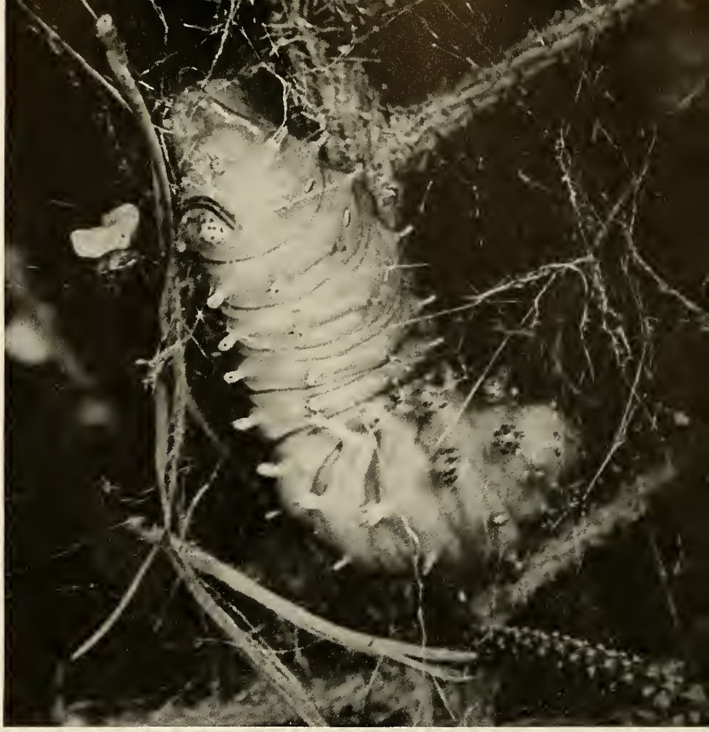
The camera
brings us closer
than we ordinarily get
to one of the wonderful
transformations in
the insect world

By
LYNWOOD M. CHACE

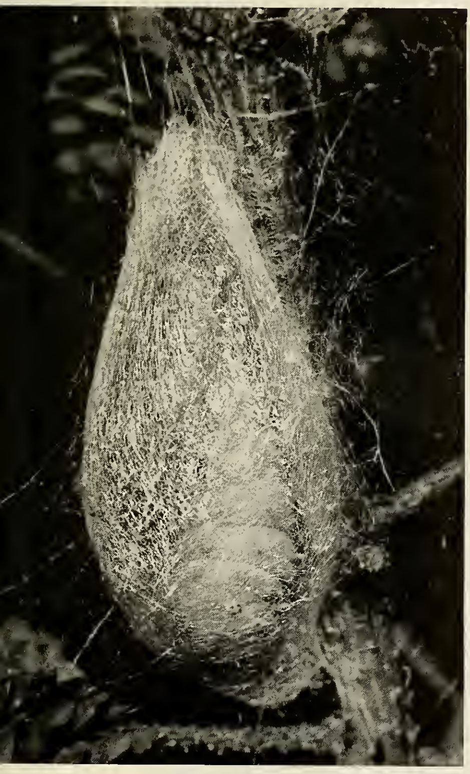
A Cecropia Moth Emerges

◄ EVERY SO OFTEN the caterpillar of the Cecropia moth sheds its skin. Here is the discarded skin in a wrinkled condition

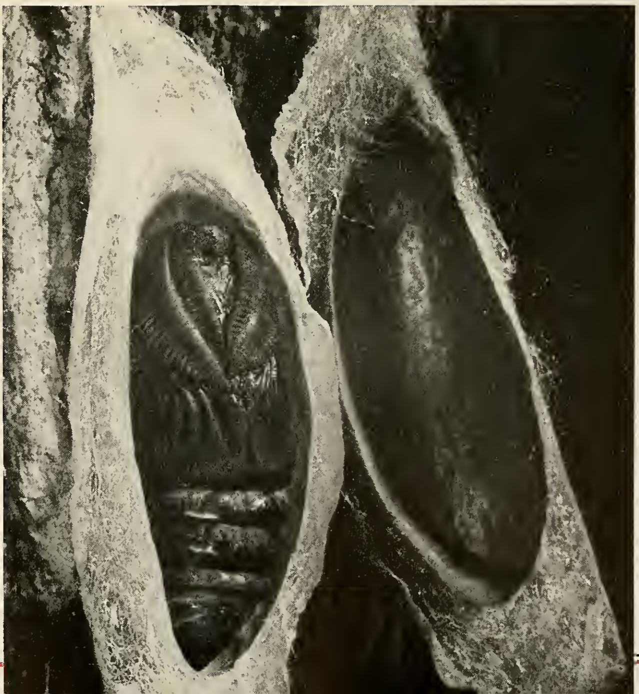
► WHEN THE CATERPILLAR reaches a certain stage, it begins to spin a cocoon for itself, producing the silk substance from its mouth. The caterpillar slowly waves its head back and forth, attaching the silk strands to objects to form the cocoon

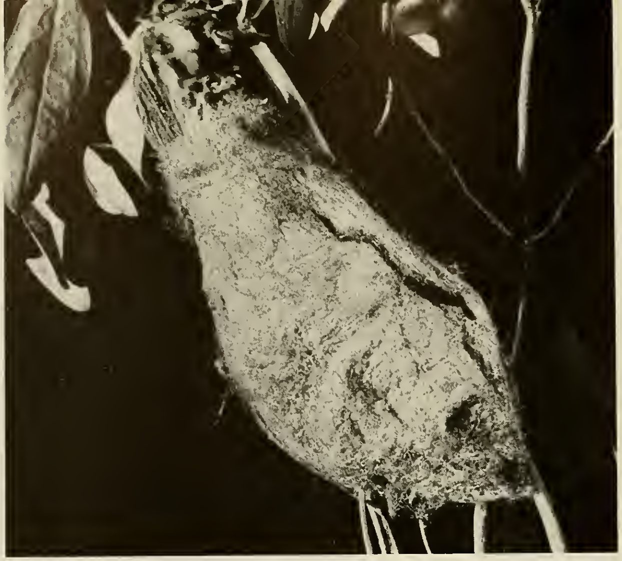


▼ HERE THE COCOON is almost completed. Its walls are still thin, and you can see the caterpillar within. The insect is now hard at work constructing the interior of the cocoon



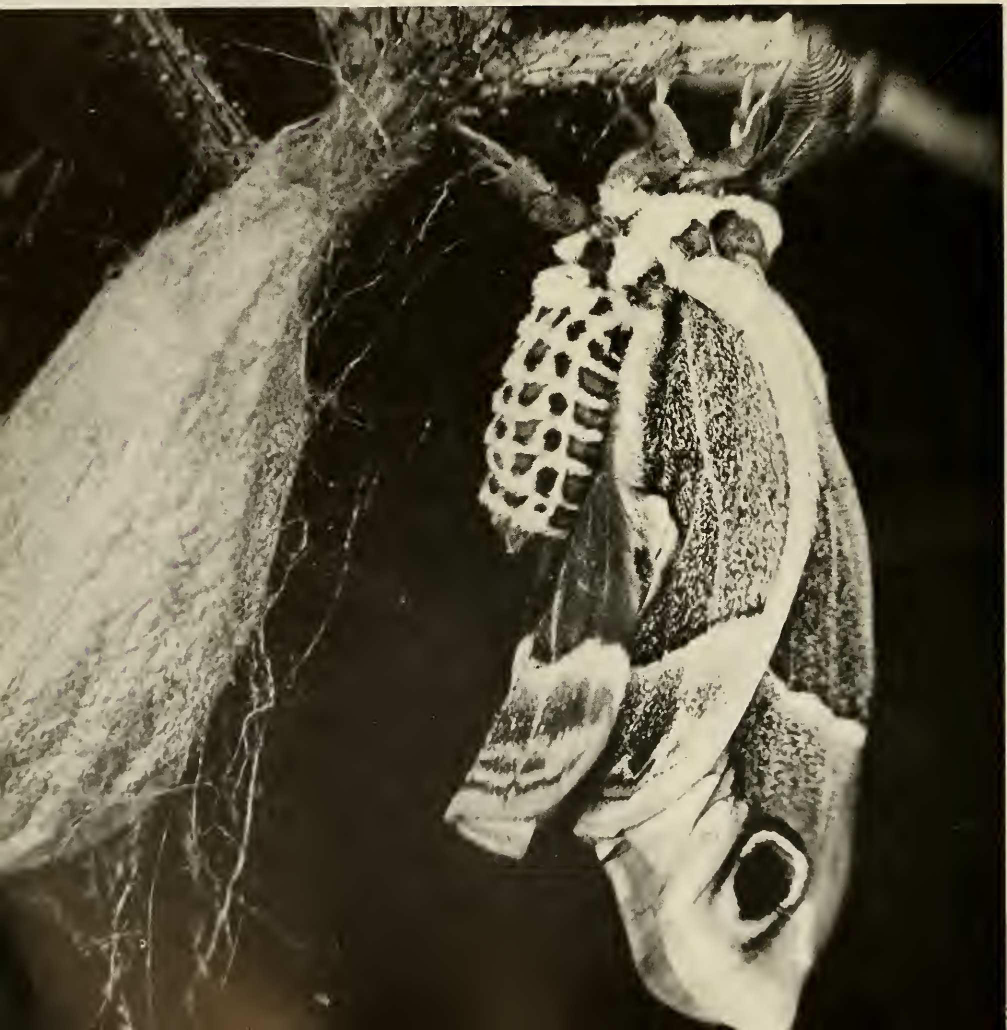
▼ HAVING COMPLETED the cocoon, the Cecropia caterpillar sheds its caterpillar skin and goes into the pupa stage. Here the cocoon is cut open to expose the odd-shaped pupa. The cocoon is carefully constructed with an outer silk layer and an inner one of silk packing. Thus the pupa is protected from freezing in cold weather. The moth does not hatch until the following spring

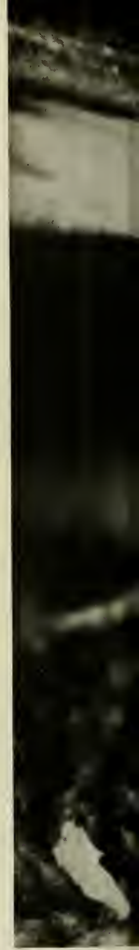


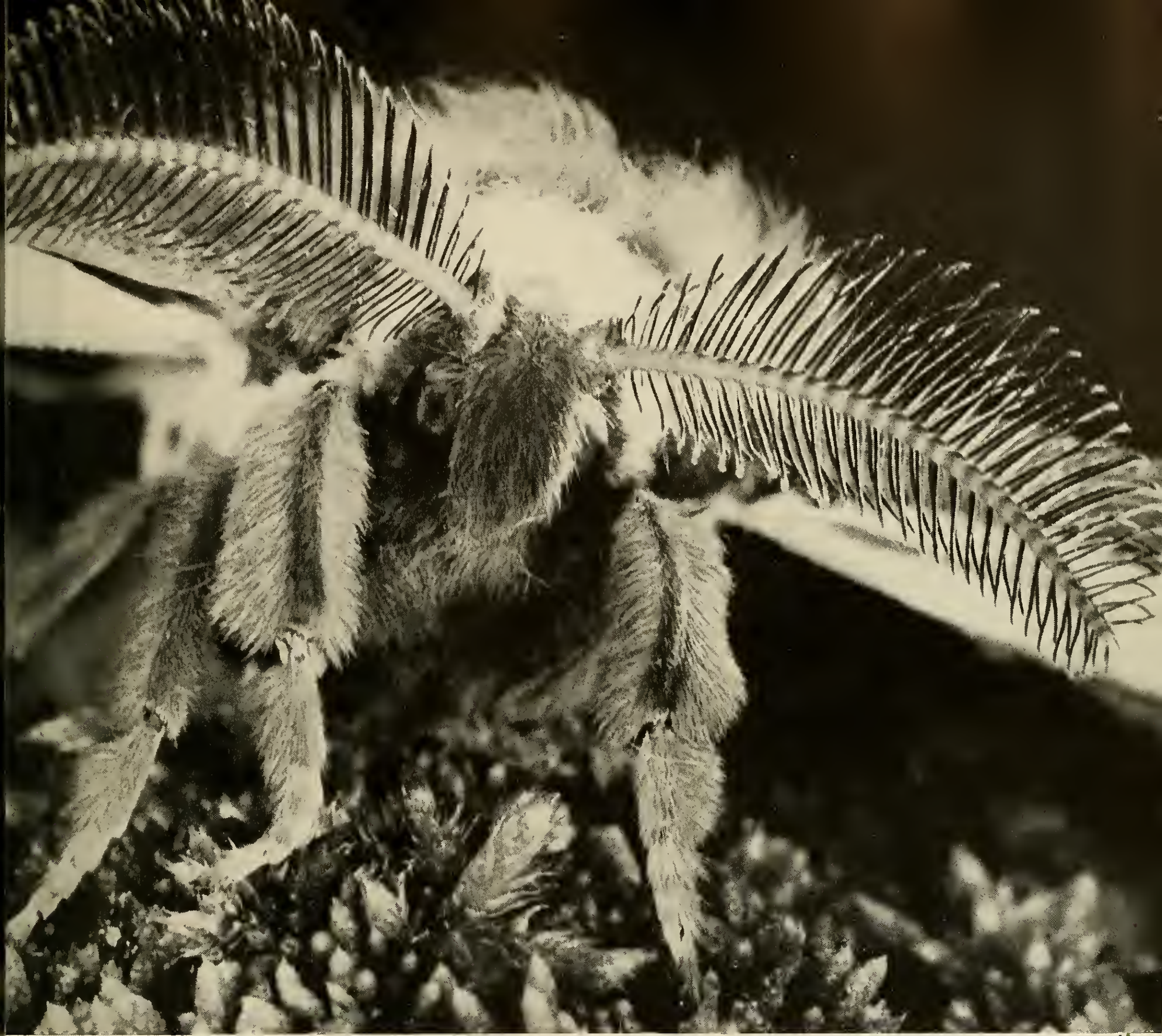


◄ WHEN the weather gets warm the following spring, the moth emerges from the cocoon to renew the cycle enacted by its parents

▼ WHEN THE MOTH first crawls out of the cocoon, its wings are soft and very fragile. It clings to a twig until its wings are fully developed. This is a male Cecropia

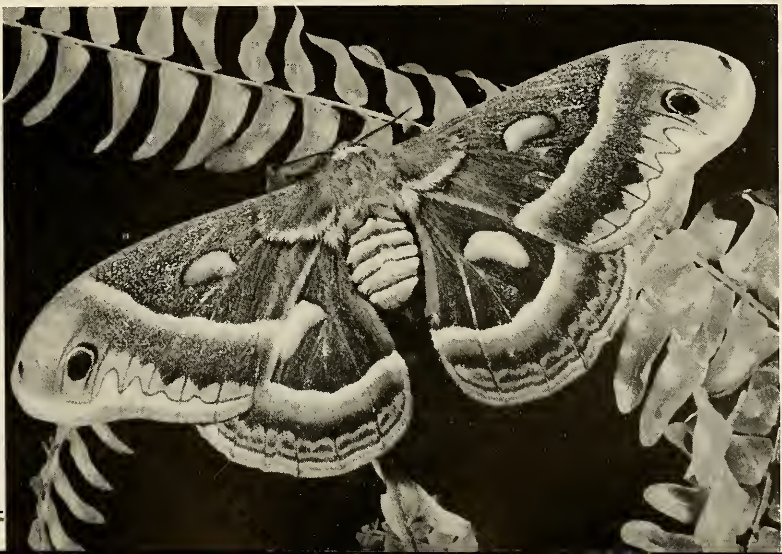






▲ Viewed at close range, the fernlike antennae of the male Cecropia and its shaggy "face" give it a fantastic appearance. But most of us see the insect at a greater distance — as a handsomely patterned creature of the air

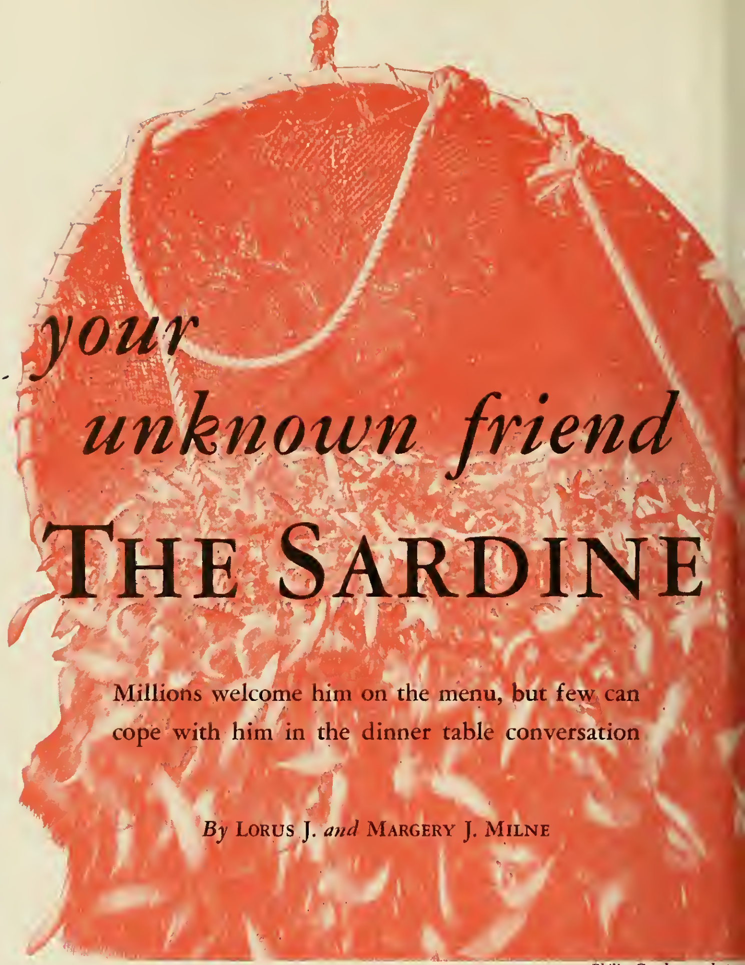
➤ The female moth, which emerged from a near-by cocoon, is likewise a beautiful creature. Its wings, now fully spread, display a lovely pattern



your unknown friend
THE SARDINE

Millions welcome him on the menu, but few can cope with him in the dinner table conversation

By LORUS J. *and* MARGERY J. MILNE



Philip Gendreau photo

Acme photo

HOMEWARD BOUND: well loaded with sardines, the purse seiner leaves the fishing area and heads for port

We were on familiar terms with sardines laid neck to tail in olive oil, but it took a whale to introduce us to a live sardine. We knew the sardine in mustard, in chili sauce, and in just plain "oil"—all neatly packed in a can with a key, but the living fish, complete with head, insides, and particularly scales, in its home at sea—that was completely beyond our experience. So were whales, in spite of Frank T. Bullen and Herman Melville. But our introduction occurred on board a little fishing boat off the Maine coast near Ogunquit, on a course that led to lobster traps.

When a Maine fisherman, minding his own business, sees a whale surface and spout a few hundred yards from his boat, he doesn't shout, "Thar she blows!" He doesn't even yell. But he may remark drily, as one did to us: "Must be sardines yonder." For whales are a major peril to small fish, and sardines (before canning) live in schools that number upward from three billion individuals to populations of nobody knows how many.

The finback whale that made the introductions occasioned us so much excitement that we almost missed the skipper's casual comment. Sardines had no space in our minds while a live whale, our first, was humping its huge back into sight as though riding the curve of an enormous barrel rotating slowly below the surface. The blackish mound would rise into view, only a foot or two out of the water but as broad as our boat. The blowhole would open and a cloud of vapor push up 20 feet into the air like a miniature of Old Faithful. Then the smooth movement of the forward roll would take the head below while a tremendous back heaved over, its progress marked by a small triangular fin. But the back was as long as our 40-foot boat, and it slid from sight without a visible flip of the transverse tail behind it.

No doubt sardines by the million were rushing at top speed away from the whale. Our skipper pointed to the water just beyond our boat, and while no fish were visible, the whole surface was roiled by the movements of the swimming just below. Why they remained so close to the surface when a concerted dive might have eluded the whale, we could not guess. But the monster mammal plowed through the frantic fish, and it was easy to reconstruct what happened each time the cavernous mouth opened and closed. As the gape appeared, water and fish rushed in, but when it closed again, only water emerged. The sardines were tangled among the hundreds of hair-fringed whalebone plates hanging like thin flexible stalactites from the roof of the animal's mouth. And when the lips met once more, a great bulbous tongue rose from the floor—partly by muscular action, partly by inflow of blood into tissue spaces within—and squeezed the sardines out of their nooks and crannies, down the whale's throat.

The herring gulls above were no more concerned about the whale than were the Maine fishermen. Far from the cetacean or close to it, they recognized the turbulent water stirred by the sardine schools. In plunged the birds, to rise with fish in their beaks, to swallow them while air-borne, then to dive again for other victims, until their crops were full. This was their method of catching herring—for the Atlantic sardine along the Maine coast is *Clupea harengus*, whether food for whale or bird or man.

Almost everything in and over the sea, as soon as it is bigger than a herring, begins to eat these fish. And since herring come in so many different sizes, perhaps no one kind of backboned creature is more preyed upon by its neighbors. The bluefish and the tuna, the whitefish and the cod, the dogfish and the haddock, hake, pollock, and squid, all devour countless numbers. Seals and porpoises fatten at the expense of herring. For man "the herring is beyond question the most important of food fishes in the Atlantic, if not in the world." Small wonder, then, that the life span of a herring cannot be stated in years. Of 30,000 eggs laid annually by each mature female herring, an average of less than 2 survive to repeat the cycle. On the precision of this average rests the rise and fall of sardine populations in the sea. And on the 29,998 or 29,999 that are lost each year from each pair of Atlantic herring, numberless creatures depend for their own survival.

To survive so many successful attacks by enemies, sardines themselves must find plentiful food. Each of them is equipped with a sort of sieve in the gill region, which effectively strains out food particles from the water. The particles are microscopic algae and other minute plants in the upper levels of the sea (where sun energy can penetrate), plus the hordes of barely visible crustacea and various animalculae. Collectively these are known as plankton, and the sardine is a plankton feeder. Of all the small creatures on which herring thrive, almost the only one to have a common name is a tiny crustacean belonging to the genus *Euphausia*. It is known to fishermen as "red seed," because it becomes so abundant as to color patches of the sea. Sardines take both the algal plankton on which these crustaceans feed and the crustaceans themselves. Finback whales are equipped to filter from the same water both the "red seed" and the sardines that prey upon them.

Since no animal is more than ten per cent efficient in its use of food, a ton of sardines represents at least ten tons of "red seed" or similar food. And the "red seed" require at least ten times their own weight in algal plankton—hence a ton of sardines in this simple food chain rests on a minimum of a hundred tons of microscopic plants. A ton of whale represents further inefficiency and demonstrates how incredibly abundant are the living green "pastures of the sea," which supply the needs of "red seed" and sardines and whales and keep ahead enough to reproduce themselves as well. Man tends to overlook the immense quantities involved, but herring keep browsing until death overtakes each fish. Not that the huge population is wiped out at any one age. Some reach a length of eighteen inches—as multiple grandparents of more little sardines. Such a giant herring may be twenty years old,

R. Gates photo from Frederic Lewis

Nets filled with the sardine catch are emptied into a small boat, which will transfer them to the fishing fleet. In New Brunswick waters while those a gull or man prefers—five inches or less in length—have not yet reached their first birthday. Most of each 30,000 never live that long. But a ten-inch herring has reached reproductive age and is usually about three years old.

The eggs of the Atlantic herring are heavy; they stick together and sink to the bottom. The most valuable sardines of international trade, however, start out in no such fashion. They are the French sardines—luxury tidbits that gave the common name to the whole group of little fish, because Sardinia, in Mediterranean waters, was where this delicacy abounded. And a French sardine comes from a buoyant, floating egg—one of 60,000 each mature female lays through the summer. Properly these fish are *Clupea pilchardus*, and if not caught as yearlings to be canned in the familiar manner, head to tail, they may attain a length comparable to that of the Atlantic herring. In Norway there are two kinds. The Grade A sardines are known as *brisling* and are *Clupea sprattus*. The others are called *sild* and are *Clupea harengus*.

The word "sardine" has fallen into confusion. As popularized, the term has come to refer to any small fish that can be canned. To a Californian the word signifies what he calls a pilchard, *Sardinops coerulea*, caught at a size where two cleaned fish may fill a fifteen-ounce can. Such pilchards are caught in purse seines to an annual total of between 250,000 and 500,000 tons, and their market value amounts to at least 19 million dollars. Such fishing methods miss the small individuals and commonly take fish after they have reproduced at least once. Maine sardines, sought close to shore in smaller sizes, are all immature fish. Four to a dozen of them go into a 3½-ounce can; and those that are marketed annually in this way total only slightly over 40,000 tons, but they have a market value about equal to the total output of the California "sardine" industry. With the exception of cod, haddock, menhaden, and rosefish (redfish), more weight finds its way to the fish markets from the herring family than from any other source. Only salmon and tuna exceed the sardine and herring fisheries in value.

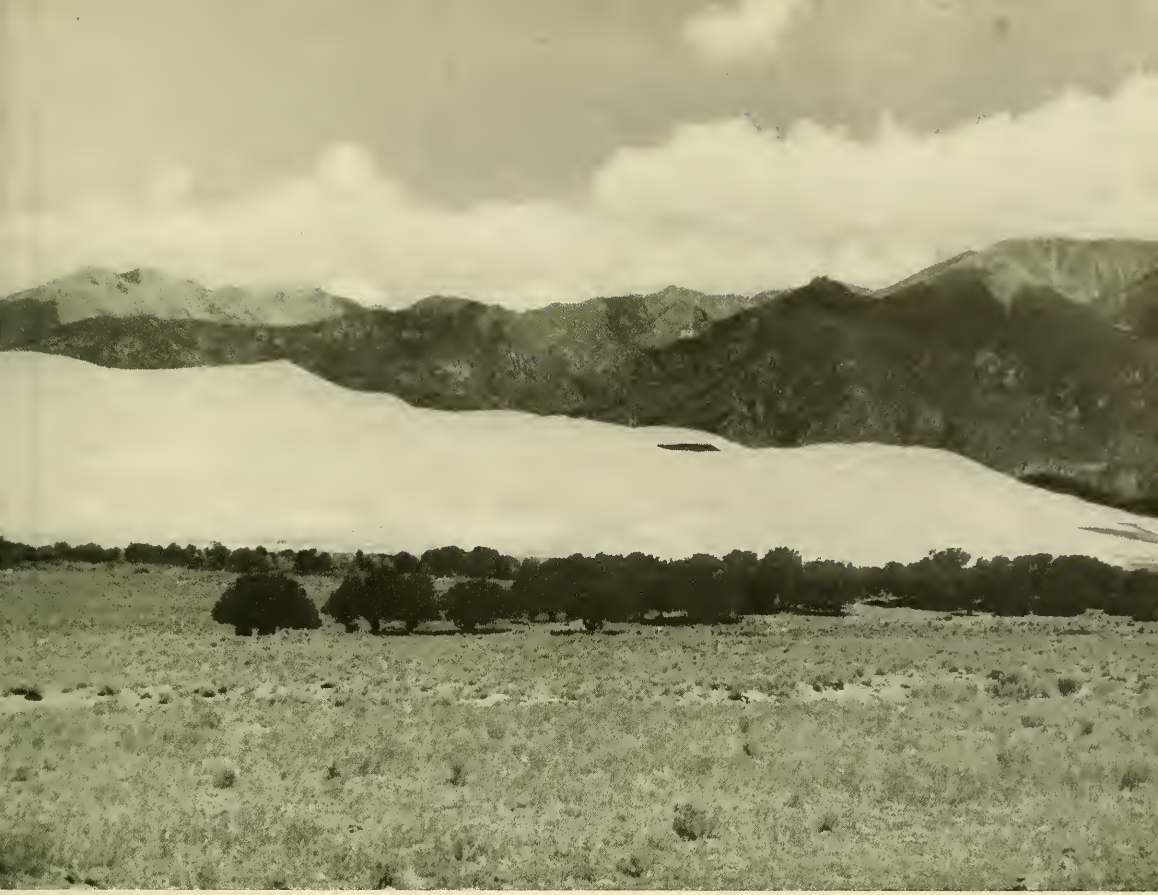
Atlantic sardine fishermen usually seek out regions where the fish breed in large numbers and then trap the young as they roam in schools. With so many mouths in a single group, there must be a tremendous demand for food, and sardines are apparently very sensitive to the taste of nourishment diffusing through the water. They will swim toward bait made of the salted roes of cod and other fishes, and they may be induced ("toled" is the word) into traps built of branches driven into mud flats. These are "brush weirs" such as are used extensively in the region around Eastport, Maine, at the Canadian boundary—the center of sardine catching and processing for the Atlantic coast. In a sense, a brush weir is a net made of interwoven plant materials, but the important feature is that it extends into the bottom, and through that bottom the fish cannot escape. In deeper water, a similar enclosure may be achieved through use of a pound net, whose sides are continuous with the bottom. The name refers to the impounding of the catch. Pound nets for sardines are often supported by a circle of floats, and the mesh is fine enough to limit the catch to useful sizes.

Wherever sardines are held captive, the surface of the sea takes on a curious, glittering appearance from countless minute scales. These fish have a poorer hold on their overlapping armament than most, and the mere brushing of one agitated animal against another serves to scrape loose the light-reflecting, tough transparent flakes. Often the scales, like sequins on a dark sea, are clues along the Maine coast to the arrival of a sardine boat—a floating factory more bulky than a finback whale and more destructive to the fish. Sardine boats can be anchored wherever sardines are abundant. Each boat is ordinarily equipped with a special boom from which a funnel-shaped net can be lowered into a passing school of herring. A huge pump on board then inhales a continuous stream of water from the funnel through a six- or eight-inch hose and sucks in sardine and sea together. Both emerge into a pound net on the opposite side of the vessel, the fish to be dipped out and processed at leisure.

Right on board, the fish are finally cleaned and sorted for size. Sea water rinses away the loose particles before the sardines are raised from the tanks on screens to drain. When almost dry, the fish and screens in vertical layers may be lowered into boiling cauldrons of oil—olive oil for high-grade small fish, cottonseed or peanut oil for poorer quality—and when cooked enough they are raised again to drip. Packing in cans requires hand labor, but the work proceeds with amazing speed. The waste parts, meanwhile, are dried as fish meal or manure. The canned fish go to the sardine boat's hold, while bags of fish meal are piled on deck. When sardines are running, several families may live on a single boat for weeks at a time, lending hands for the work and amassing a valuable cargo.

A sardine boat in American waters offers few of the niceties characteristic of the European sardine industry. There the gill nets are dyed blue, supposedly to conceal their meshes from the fish, though also to preserve the fibers. The season must be right for a French sardine to have the proper flavor, and cooking them becomes an art to save the savor and maintain the texture of the meat.

Likewise, the herring along the New England coast can only claim membership in this class of delicacy when quite small. Thereafter, if they escape to live to larger size, they come to the market fresh or dry as "red herring" or slightly salted and smoked as "kippered herring" or "snacks." When larger still, and strongly salted and smoked to cure the meat, *Clupea* becomes a "bloater." Thus modes and methods differ around the world, as do the fish that bear the general name "sardine."



▲ In the glare of noon the dunes look like a phantom range of snow against the timbered foothills of the Sangre de Cristo

THE Naked Hills

A migrating desert that is urged slowly ever eastward by the force of the winds

By Robert M. Ormes

Photos by H. L. Standley

THE dune areas are museums of modern art. Their hills, modeled from pure sand by the wind, have the mysterious quality of abstractions. With none of the customary clothing of plant life and only the slight variations in color provided by light and shadow, they seem too stark for reality. Nowhere in the vast museum of surface geology are the forms so simple and repetitive and yet so endlessly absorbing.

One of the most curious of these areas is the Great Sand Dunes National Monument. Its sands, collected from the shore of a long-forgotten inland sea, now form a baby four-by-ten mile desert in the heart of the Colorado uplands. Their floor is the San Luis Valley, a large flatland 8000 feet above sea level, where crops of potatoes, lettuce, and peas are raised. The valley itself would be a semidesert but for the plentiful supply of artesian water. It is cradled among hordes of peaks that run up to 13,000 and 14,000 feet.

Under the urge of the prevailing wind, the dunes have crept across the valley to its eastern edge. If the present migration continues, they will eventually pile up among the green-timbered foothills of the Sangre de Cristo Range. It requires no more than a moderate

breeze to keep the sand sifting its way upslope, and when the air is strong there is such a multitudinous tinkling of the grains that the whole dune seems to hum with life.

There are two distinct types of sand granules. One kind is a dull tan and nearly spherical. The other particles are smaller and more angular, and they have a wide variety of colors ranging from deep gray to pinks and blues. Assays from various parts have shown a modicum of flour-fine gold but not enough to make recovery worth while.

In the central part the dunes are well over 1000 feet high. In the clear atmosphere they can be seen from 50 miles away. They have brought comments from travelers ever since Zebulon Pike wrote about them in 1807. The numerous artifacts found in the

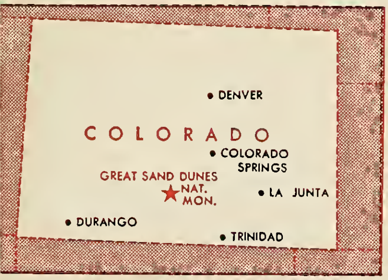
▲ THE DUNES move eastward in a series of slow cascades

▼ LONG SHADOWS are needed to show the work of the free-hand sculptures of the wind. The ripple marks are dunes in miniature

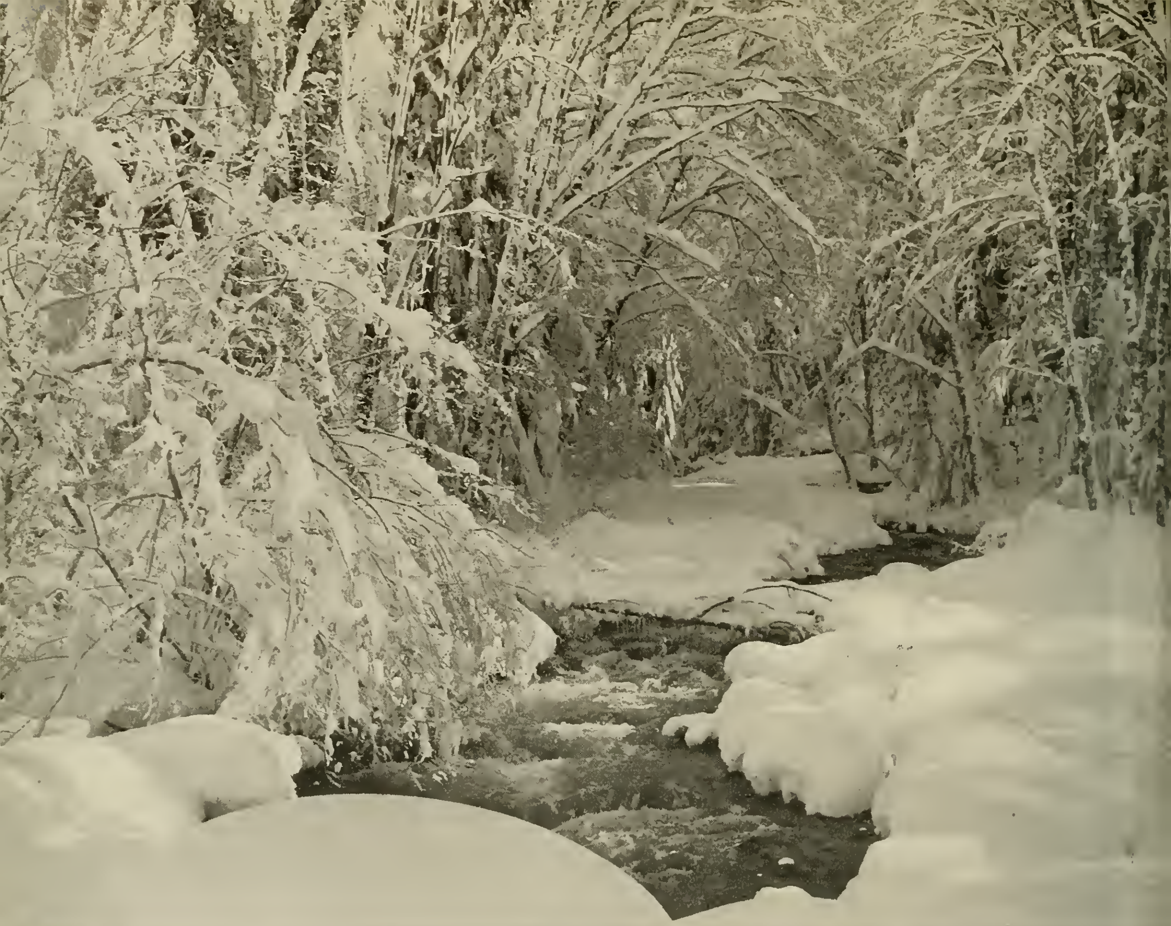
▲ NATURE, THE SCULPTOR, shapes modernistic-looking mountains in duneland, and the lines are sharp but never straight

neighborhood indicate that the Indians, too, were attracted to this region.

Odd stories and legends persist about the dune country. One of them is about a troop of web-footed horses that are supposed to course over the sand as fast as if they were on hard ground, because their hooves are widened, overgrown versions of the normal. But we have not yet come by anyone who has seen these horses, and it seems dubious that they could make a living even from the sparse grasses of the periphery. Perhaps closer to the realm of possibility is the sheep story, which states that a shepherd and his whole flock disappeared among the dunes, and likewise the story of two teamsters whose wagon and hobbled mules were swallowed up by quicksand while they slept not far away. If there is any truth in these stories, it seems likelier that they can be explained by a visitation of bandits from Mosca Pass, which cuts through the Sangre de Cristo just west of the dunes and was for some time used as a wagon trail.



Skiers who visit the dunes can have an amusing time. In uphill work they avoid some of the strength-sapping influence of the sand, and with a hard wax they manage to get some good little downhill runs. But the real sport among the dunes is for the visitor who listens to their whispering and plays his eye over their rhythms and undulations.



▲ **One of nature's innumerable crystal palaces in the Cascade Mountains of Oregon: a snowbound stream emerging momentarily to add the music of its waters to the muffled stillness**

Winter through the Camera's Eye

By Ray Atkeson

WINTER storms sweeping in from the Pacific Ocean usually mean heavy snowfall in the higher elevations on the western side of the Cascade Range. Indeed, few areas in the world offer such an abundance of snow within a short distance of many large towns and cities. These photographs show several aspects of the fantastic winter fairyland that results.

Until recent years, residents of the Northwest were content to leave the snowbound wilderness in its natural state of loneliness. Now the situation is quite different. Modern highways, kept cleared of snow by giant rotary snowplows, have opened up the Northwest's winter wonderland to visitors bent on a variety of outdoor activities. All along the once snowbound crests of the Cascade Range there are numerous winter playgrounds. Some of the resort hotels nestle snugly in snow fields that are 20 to 25 feet deep.

Other persons keep a more serious eye on the work of the winter storm gods. Farmers watch the higher mountain peaks and pray for the deep snows that will ensure moisture for irrigation of crops in the valleys during the dry summer months. And forest officials hope for winter storage of moisture to hold in check the dread fires that sometimes cause such havoc.

The Northwest has finally come to appreciate the value of its snowy heritage.

➤ A SKIER'S DREAM of heaven comes true in the vast rolling foothills of Mt. Baker in Washington

▼ CHRISTMAS-TREE LAND: Mt. Hood rising sublimely beyond the spires of the evergreens

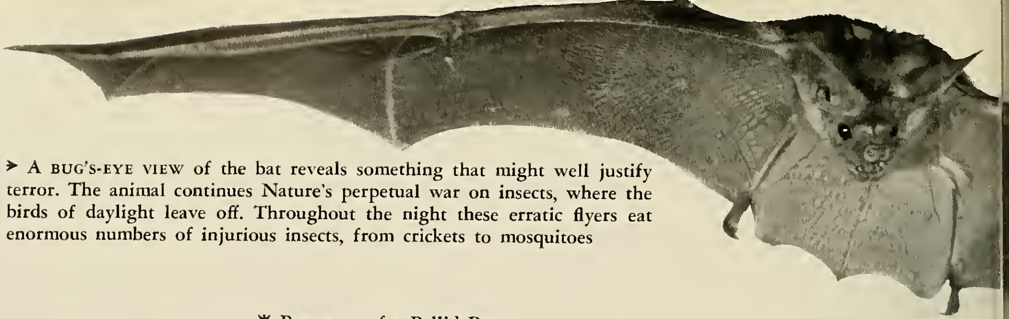
➤ Roaring through the forests and mountains day and night, a fleet of these giant rotary snowplows battle the element to keep the highway open to the very rim of Crater Lake

▼ Just below timber line on Mt. Hood is the Wyieast Club's Ski Hut, nestled in a protected glade in the heavy forest

▼ Bent not on recreation but on securing vital information, a small group of hardy men pass the winter measuring and estimating the moisture content of the snow. Many occupations and ways of life are affected directly and indirectly by their reports. The Forest Service makes plans for controlling forest fires; farmers learn how much water they can expect for irrigation; and power plants foretell how carefully they must husband their reservoirs of water for the production of electricity

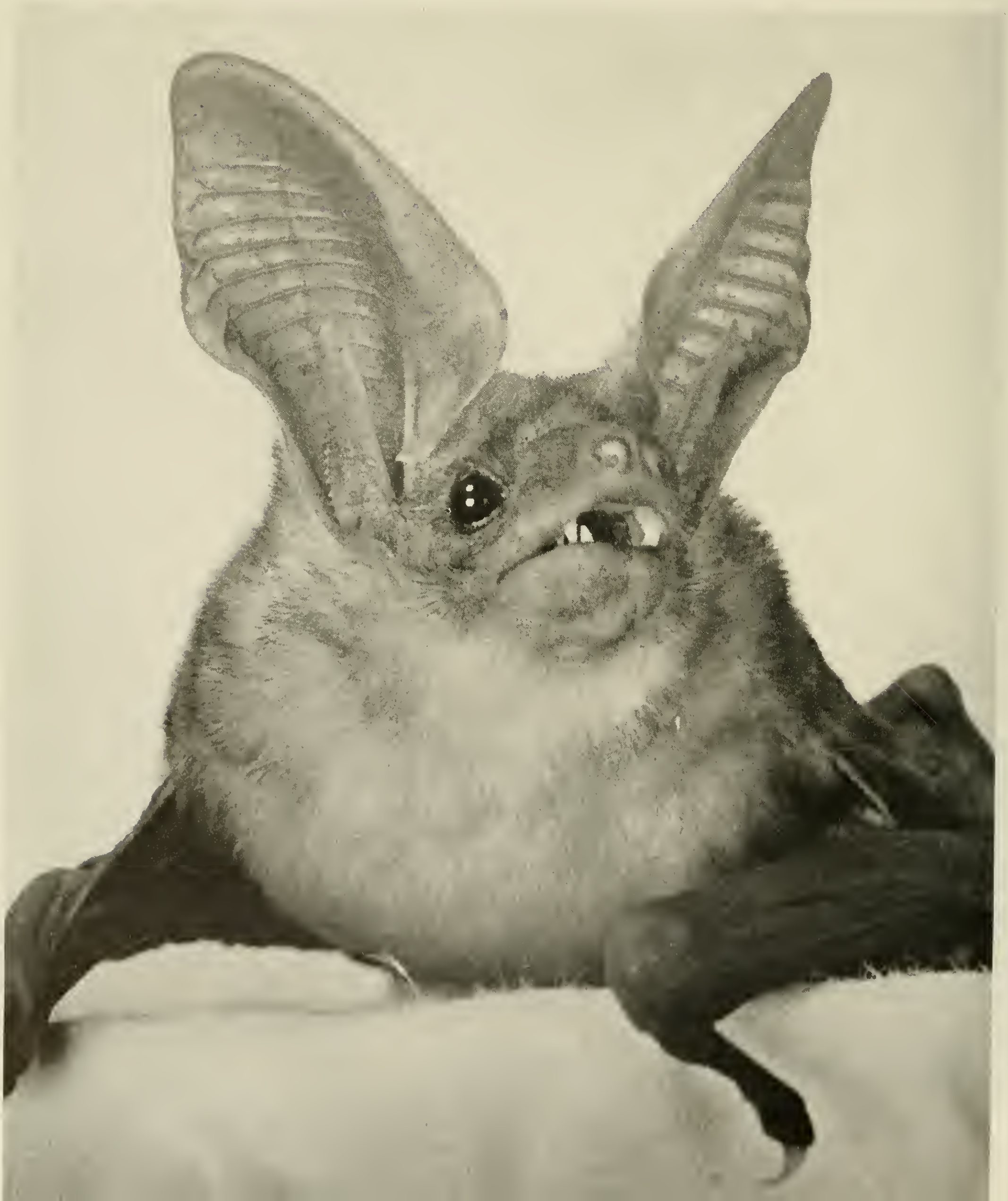
▲ **Mt. Baker**, lofty snow-mantled monarch of northern Washington, looks down on one of the most beautiful winter playgrounds on the North American continent

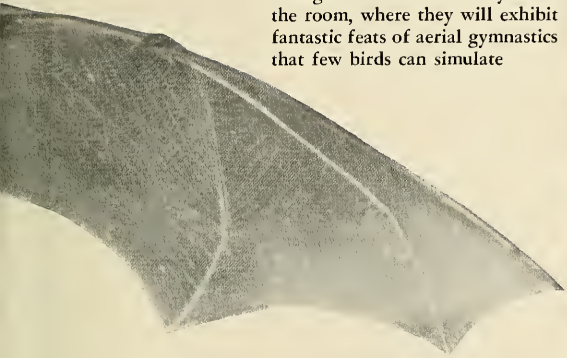
◄ **Wizard Island** seems to float like a snow-white jewel on the turquoise waters of Crater Lake

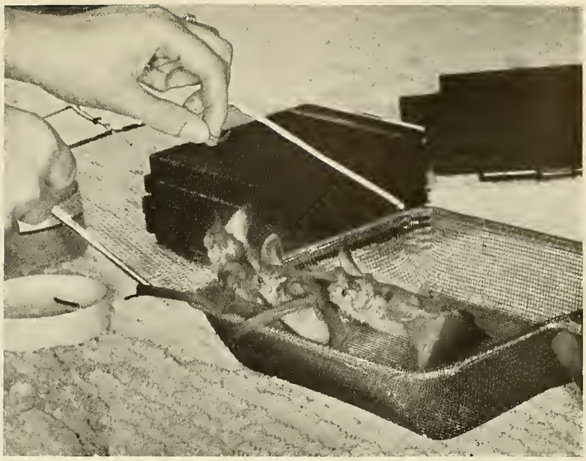


➤ A BUG'S-EYE VIEW of the bat reveals something that might well justify terror. The animal continues Nature's perpetual war on insects, where the birds of daylight leave off. Throughout the night these erratic flyers eat enormous numbers of injurious insects, from crickets to mosquitoes

➤ PORTRAIT of a Pallid Bat







➤ **Bats train** easily to come to the hand for food. They can either be cage-fed or allowed to fly about the room, where they will exhibit fantastic feats of aerial gymnastics that few birds can simulate

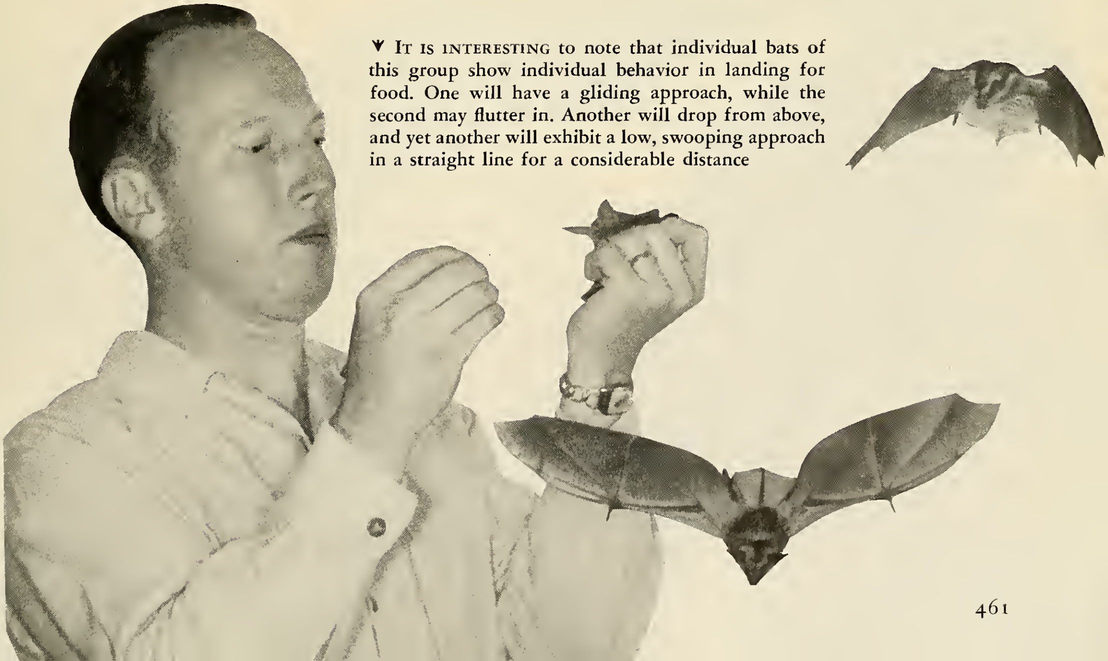
How Bats Fly

By Richard L. Cassell

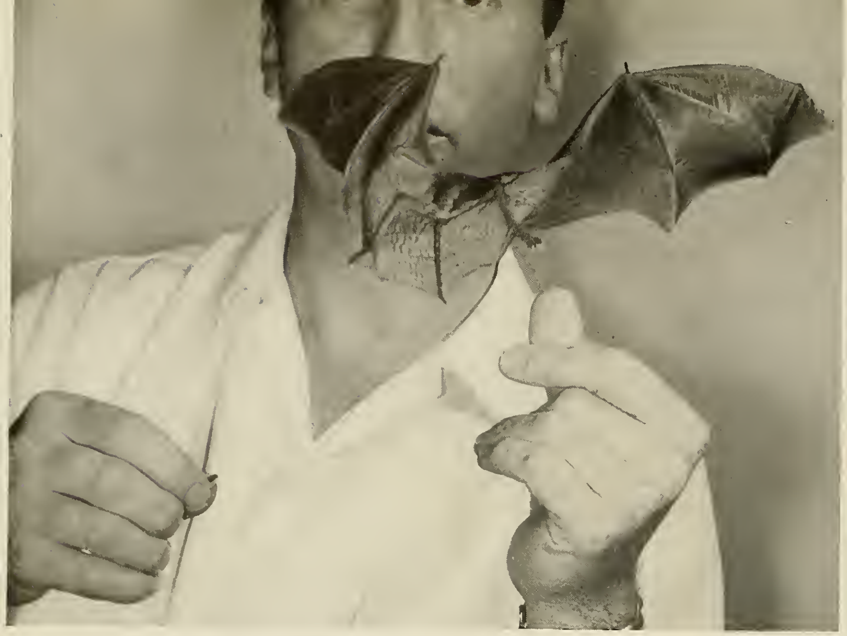
One of the most remarkable series of photographs to come from the super-speed camera shows how the only flying mammal maneuvers with consummate skill in a medium it has taken his two-legged cousins centuries to master

In all nature probably no other creature is as shrouded in myth, superstition, and misinformation as is the bat. His weird appearance and choice of darkness readily make him an object of false conclusions.

In reality the bat is quite attractive. He will usually become tame in a few hours, showing evidence of affection and intelligence. He is clean, adapts himself to confinement, and soon proves himself not at all the Dracula of the movies or the sinister figure of fiction but a personable character, with traits commendable in any pet.

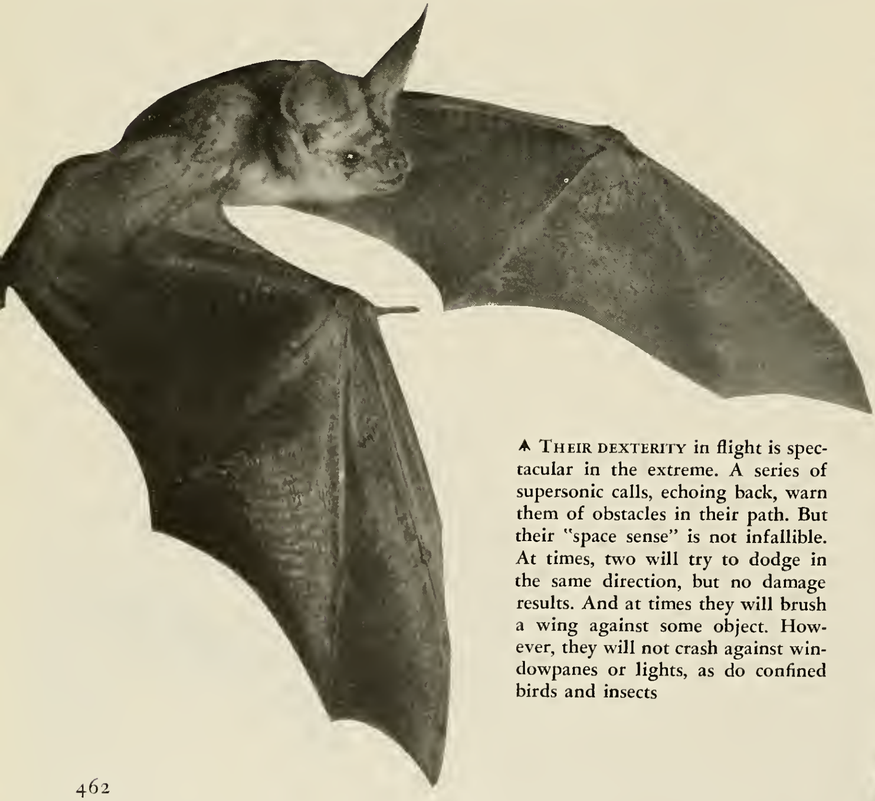


➤ **It is interesting** to note that individual bats of this group show individual behavior in landing for food. One will have a gliding approach, while the second may flutter in. Another will drop from above, and yet another will exhibit a low, swooping approach in a straight line for a considerable distance



▲ Sound, not sight, seems to be the bat's principal means of perception in determining position, direction, size, and form. Here, the pet bat is guided to the hand for food by the snapping of the fingers. There need be no audible sound. The bat's extremely acute sense of hearing will bring immediate response from any part of the room

▲ Guided by sound to the left hand, Flapper Fanny is handed a beetle larva. Mighty Joe hovers above



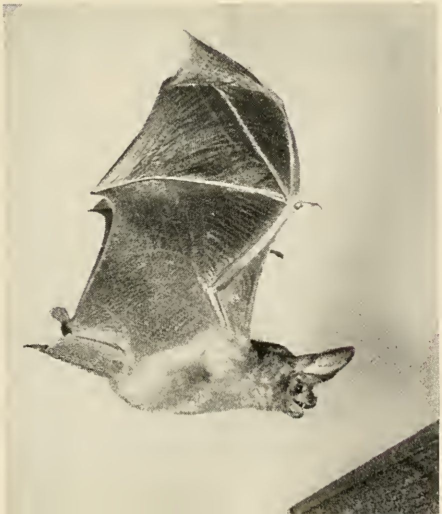
▲ Their dexterity in flight is spectacular in the extreme. A series of supersonic calls, echoing back, warn them of obstacles in their path. But their "space sense" is not infallible. At times, two will try to dodge in the same direction, but no damage results. And at times they will brush a wing against some object. However, they will not crash against windowpanes or lights, as do confined birds and insects

▼ Most bats are gregarious and will have a favorite resting place. In this particular instance, a picture hanging from the wall was the choice. Here, Mighty Joe "drags the field" before coming down

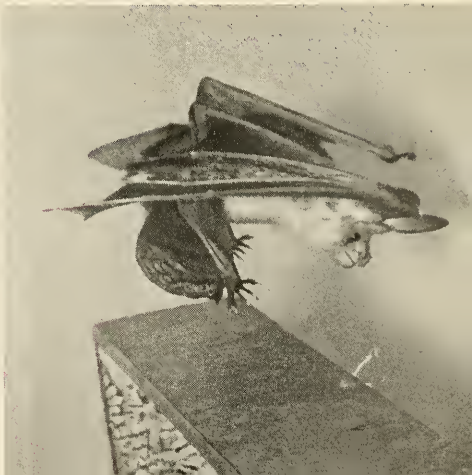
➤ **During feeding,** traffic jams are frequent and collisions imminent. Often one or more bats will remain clinging to the hands to gobble all the food and obstruct landing facilities for the others. But usually the tidbit will be snatched from the fingers, and flight resumed within a fraction of a second. The fingers may be chewed quite unintentionally in this maneuver, but such bites are infrequent and harmless

Thus modern photography proves that a creature man has disdained has long been the master of some of the finest tricks of aviation skill

⮟ **Lining up** with the "runway" on the final approach, Flapper Fanny prepares to stall out



⮟ **The "touchdown"** is accomplished by the split-second reduction of wing area. The skirt between the legs pockets the air and reduces forward velocity



An Orchid

of the CHAPARRAL

Its seed is as fine as dust, but the mature flower has a mechanism for pollination that is a marvel to all who have watched it in action

By Jerry Laudermilk

Drawings by the author

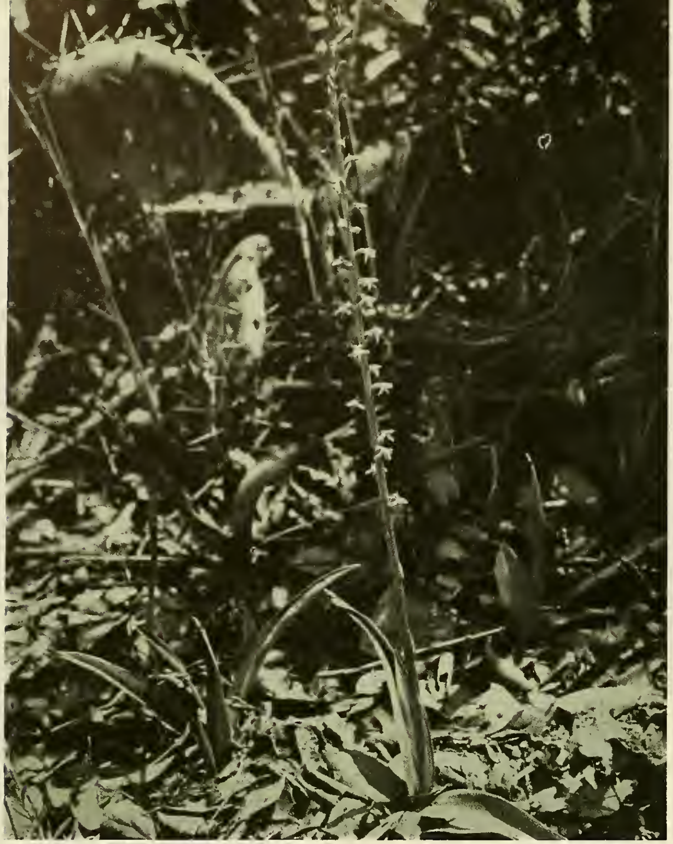


Photo by Helen Laudermilk

◄ The rein orchis, *Habenaria unalascensis,* which grows as far north as Unalaska, is here seen among prickly pear, squawbush, poison oak, and other plants of the dry chaparral. Photographed near Claremont, California

I WAS on the trail of an elusive orchid. Generally, when a yarn begins like this, it prefaces a jungle saga wherein the explorer staggers through mud, snakes, and mosquitoes in the wake of a treacherous native guide. But the locale and circumstances of this expedition were altogether different. The scene was a dusty stretch of chaparral inhabited by poison oak and devilish red ants that could outsting a wasp. My guide was a sinister and ponderously brilliant student who knew more botany than I and wouldn't laugh at my jokes. But to get on with my story . . .

According to this student – who swore he had collected orchids in the same territory the year before—we were "getting warm." This statement was true according to any of three different interpretations: geographically, physically, or temperamentally. In fact, I had just begun to associate the idea of the piece of clothesline around my plant press with that of the student's fat neck, when he made noises from his post at the head of our two-man safari, indicating that our objective had been attained.

When it came to locating a space about 15 feet square in the middle of 160 acres of chaparral, all of which looked alike, this student was a wonder. Here, on the desiccated slope, hobnobbing with a gang of colorful plant characters known as sotol, prickly pear, buckthorn, and sagebrush, stood about a dozen cool, self-assured individuals of the small, green-flowered rein orchis *Habenaria unalascensis,* which ranges all the way from Unalaska Island in the Aleutians to the south end of California.

Like practically all our native orchids—and about 150 species can be found inside the United States borders—this Habenaria is rare without being actually scarce. It has perfected a knack for keeping out of sight. The plant is green all over, its leaves wither by flowering time, and by early summer it is ready to close up shop for the season without having advertised its stand to any but the dozen or so nature-wise folks in the neighborhood.

Going by externals only, it takes a robust imagination for anybody not initiated into the secrets of plantdom to see any relationship between the unpretentious, greenish-white Habenaria flowers and those elegant, mauve or shell-pink "creations" that come out of hothouses. But if you look closely with a lens and poke about a bit with a needle, you will soon find that Habenaria's floral architecture holds all the credentials for membership in the illustrious clan of the Orchidaceae.

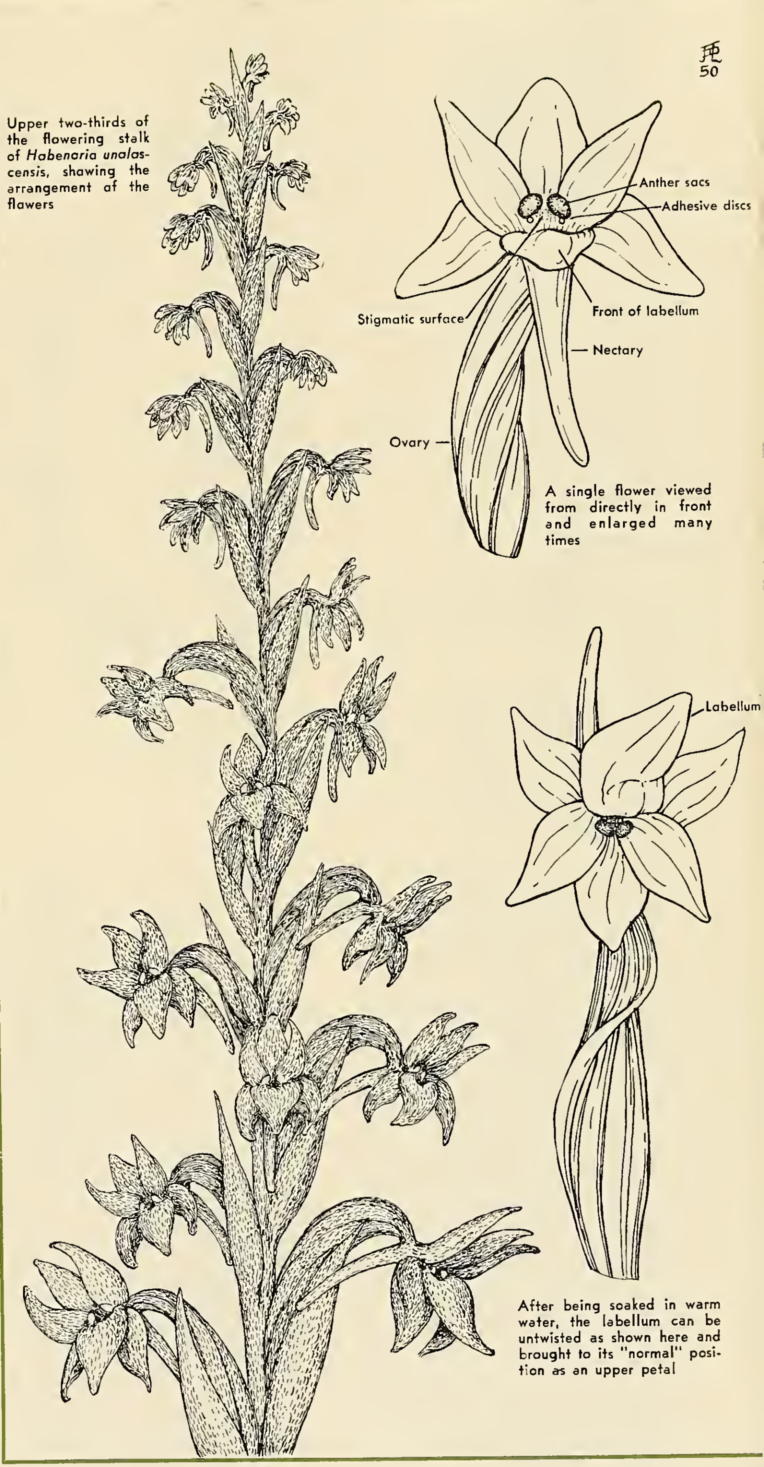
Orchids have three sepals and three petals. One petal is usually modified out of all proportion to any of the others. This petal is called the *labellum* or lip and is the most obvious of the orchid's peculiarities. In many species the labellum has been fashioned by that old firm of floral architects, "Function & Efficiency," into a highly decorative container loaded with nectar.

This *nectary* or honey-vase is displayed like an advertisement to attract insect customers—and I mean customers instead of guests, because visiting insects have to do a certain amount of work to pay for their refreshment. But I'll come back to this part of my yarn later; right now let's look a little deeper into what a flower must do before it can qualify as an orchid.

Now, the orchids are second cousins to the lilies by way of the irises; and the labellum I just mentioned is actually an upper petal that has been twisted halfway 'round—from the twelve to the six o'clock position — where it functions as a landing strip, restaurant, and signboard all combined. No imagination is needed to see where the twisting has taken place in the Habenaria flower. If you examine it through a magnifying glass, the ovary shows distinct grooves where the twisting took place. And if you will look at the drawing where I have boiled one of the flowers and untwisted it, you will notice that the labellum is now back in its original position as an upper petal. This extraordinary change in the position of the petal, accomplished by twisting, makes possible the insect pollination now to be described.

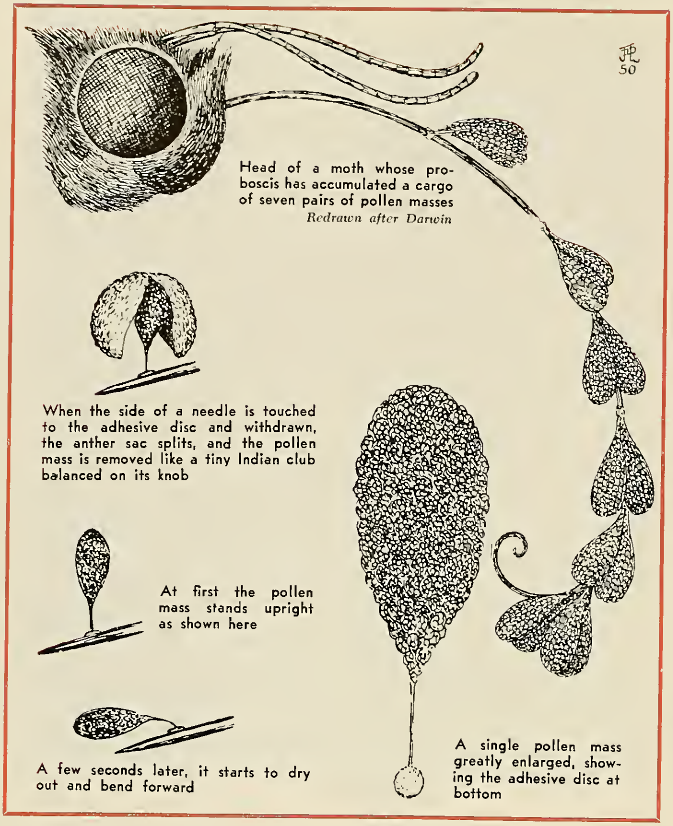
Orchids have specialized in insect pollinization, and nothing has been left to some light-minded insect's fancy. The accommodations are practically foolproof.

To gaze down a Habenaria's


Upper two-thirds of the flowering stalk of *Habenaria unalascensis*, showing the arrangement of the flowers

A single flower viewed from directly in front and enlarged many times

After being soaked in warm water, the labellum can be untwisted as shown here and brought to its "normal" position as an upper petal



Head of a moth whose proboscis has accumulated a cargo of seven pairs of pollen masses

Redrawn after Darwin

When the side of a needle is touched to the adhesive disc and withdrawn, the anther sac splits, and the pollen mass is removed like a tiny Indian club balanced on its knob

At first the pollen mass stands upright as shown here

A few seconds later, it starts to dry out and bend forward

A single pollen mass greatly enlarged, showing the adhesive disc at bottom

throat makes you feel like a Brownie's dentist. Sticking straight out at you like a tongue is the labellum. At the far end of the labellum is the opening to the nectary. Viewed from the outside, this honey-vase forms the dangling spur that reminded some Latin-conscious botanist of the checkrein to a horse's harness. Thus the orchid came to be called the rein orchis or *Habenaria*, from *habena*, meaning "throng" or "strap."

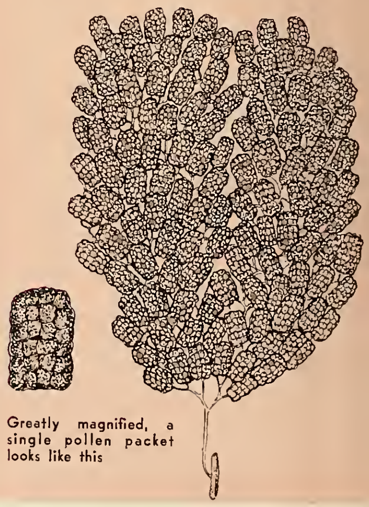
Right above the opening to the nectary—in almost exactly the same location where a normal human throat sports a set of tonsils—you will notice a pair of curious little gadgets. These are the anther sacs, all that evolution has left of the stamens. Here we have two tiny cases filled with pollen; and, unlike the majority of flowering plants, in which the anthers are fastened to the ends of the *filaments* or stamen stalks, this plant has eliminated the filaments altogether and set the anthers snugly against the back of the throat. And, to be of any use in Habenarian society, the pollen enclosed in the anther sacs has to come into contact with the stigma of another Habenaria flower.

Most flowers have their stigmas in prominent positions, where they can't be overlooked by an insect that drops in for lunch. Sometimes Nature has come very close to comedy in the arrangement of the stigma. In the Iris the trick is done by a tiny, transverse lappet, the *stigmatic shelf*, set at the doorway to the stylar arcade. The stigmatic shelf scrapes off pollen from a visitor's back as neatly as a pickpocket lifts a watch. In the case of the white sage *Salvia apiana*, the style sticks way out beyond the flower where the stigma is bound to tickle the black velvet bolero of the first bee that shows up.

These two cases represent one extreme of stigma organography; the other is shown by our orchid. Here again the flower reduced the stigma to a cluster of specialized cells located just between and below the anther sacs. This is the *stigmatic surface*, and any hit by a pollen grain is successful.

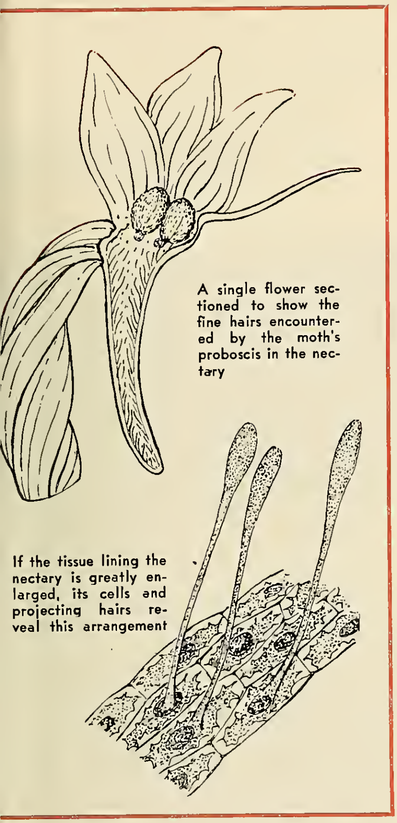
Now, flowers have developed many different systems of seeing to it that pollen reaches the stigma. In some families the wind takes care of the work; these plants throw pollen around like microscopic, yellow confetti on the chance that some of it will land where it will do some good. Some have the anthers and stigmas arranged so that if the plant fails to secure the visit of an insect, it can pollinize itself. This system is popular with some species of *Amaranthus*. Others don't take any chances at all. You find this scheme favored by the ordinary violet.

Most folks would never guess that the violet makes two sorts of flowers on the same individual: the regulation violet flower that depends upon an insect go-between, and an-



A single pollen mass further magnified and spread out to show the packets of pollen joined in clusters by waxlike strands. A single packet against a black background is barely visible to the naked eye as a tiny white speck

Greatly magnified, a single pollen packet looks like this



A single flower sectioned to show the fine hairs encountered by the moth's proboscis in the nectary

If the tissue lining the nectary is greatly enlarged, its cells and projecting hairs reveal this arrangement

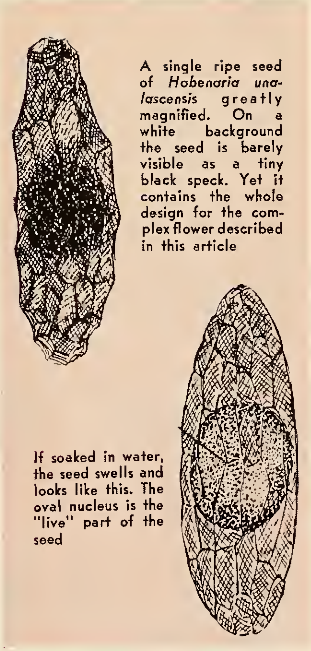
other set of flowers few people ever see. These are the *cleistogamous* flowers, which, although entirely self-sufficient, produce perfectly good seed. This system is absolutely risk-free – something like wearing belt and suspenders both at the same time. Finally, the *Yucca* goes to the extreme in insect pollination. The tiny *Pronuba* moth actually gathers the pollen with her own fair little claws, rolls it into a neat pill, waddles to the top of the stigma, and deliberately rams it into place. The entire process is almost too fantastic for belief.

With our orchid, this concurrence of functions vital to both plant and insect is as astounding as in the yucca scheme. But here the plant instead of the insect seems to take the initiative. Habenaria's pollen supply is sealed up in the anther sacs. Moreover, it comes packaged in neat little clusters tied up with microscopic threads of wax. These clusters are called the *pollinia*, and, since their operation has to be surefire, nature and evolution have so engineered things within these microscopic clusters of living cells that at the right time each pollinium will become a tiny, automatic machine.

The fact that the pollinia are scheduled to function—not at once but after the elapse of a few seconds—is just another of those profound facts that make the study of nature worth anything you may have to put into it. What I am now about to describe makes fiction seem colorless, for the actuality takes place by delayed action and the result is as certain as the operation of a timebomb. It goes like this . . .

In a flower that has not been robbed by a special species of moth, a good magnifier shows that just beneath each pollinium there is a tiny green disc. Each disc has a sticky surface. Barely touch this surface with the finest needle you can get, and the disc clings to the side of the needle with almost intelligent determination. This is the first step in a series of physical and chemical operations that are absolutely necessary for pollination to be effective.

When you pull out the needle with the discs sticking to it, the same action causes the anther sacs to split down the sides, and the pollinia are pulled out standing upright like two microscopic Indian clubs balanced on their knobs.



A single ripe seed of *Habenaria unalascensis* greatly magnified. On a white background the seed is barely visible as a tiny black speck. Yet it contains the whole design for the complex flower described in this article

If soaked in water, the seed swells and looks like this. The oval nucleus is the "live" part of the seed

Now, when the moth comes to sample the nectar, she drinks it through her proboscis—a long, hollow tube fastened to the front of her face. This proboscis is a pump and works like a soda straw. When she shoves it down into the nectary, her head and the upper part of her proboscis are certain to bump against the adhesive discs, which stick and hold fast exactly as they did on the needle. None of this pollen can possibly reach the stigmatic surface of this same flower.

When first pulled out, the pollinia stand upright exactly as they did on the needle. In this position they can't touch anything for a few seconds. It takes the moth quite a while—according to moth time scale—to finish robbing the flower, because the inside of the nectarium is lined with an unusual type of hair. This makes the moth take her time at the job, since she has to thread her proboscis carefully through the barricade before she reaches the nectar. The delay is absolutely essential, for it takes a few seconds for the cement on the adhesive disc to set firmly so that the pollinia will not be displaced in the next series of operations.

By the time the cement has set, the pollinia themselves have dried out, and as they shrink they bend over parallel with the sides of the proboscis and now point straight ahead. By this time the nectary has been thoroughly robbed. The moth pulls out her proboscis and visits a new flower. Here, contact of the pollinia with the stigmatic surface is now as inevitable as no-contact was when the pollinia stood upright. All these fine adjustments and synchronization of time, dehydration, surface tension, etc., are wonderful enough, but there is even more to the story than this.

The stigmatic surface is also adhesive but in a different way from the discs. Here the stickiness is more of the type you find on a piece of "Scotch tape"; that is, it is a sort of superficial gumminess. If this surface were either more or less adhesive than it is, the whole procession of events would collapse at this point.

Since no single flower needs all the pollen in the pollinia, only enough grains are pulled from the cluster to ensure fertilization. This bit-by-bit donation of pollen continues with each flower visited until the supply is all gone—assuming, of course, that there are flowers enough to take it. This is the point at which the degree of adhesiveness of the stigmatic surface is of supreme importance. If it were less sticky, too few grains would cling to it; if more so, the whole pollinium would be pulled from the moth's proboscis and thousands of grains would be wasted.

All this complicated procedure is directed toward a single end: to make more seeds in order to make more orchids. When I say "more" seeds I mean exactly that. A single flower of one species has been estimated to have produced 1,856,000 seeds. Habenaria can't match this output, but if half the seeds from each plant could grow to maturity, this orchid would soon be as common as grass.

But circumstances are so balanced that such a remarkable situation can't develop. Habenaria seeds are extremely small, only about 1/200th of an inch long. Furthermore, each seed is hardly a finished product, since, unlike the seeds of most plants, Habenaria seeds have no food reserve stored up to give the embryonic orchid a start in life. This means that the seedling has to make good from the start. Unless the conditions of temperature, moisture, soil, and shelter are practically ideal, success or failure for the seedling are separated by a hairline, and it probably has one chance in a thousand. So perhaps the most astonishing part of the Habenaria story is that such an unadaptable little character ever managed to stake out a claim in the dry chaparral in the first place.

THE MYSTERY OF *Twisted*

▼ A LEFTWARD SPIRALING Engelmann's spruce near St. Mary's Glacier in Arapahoe National Forest

Trees

Photo by Cora Heddington

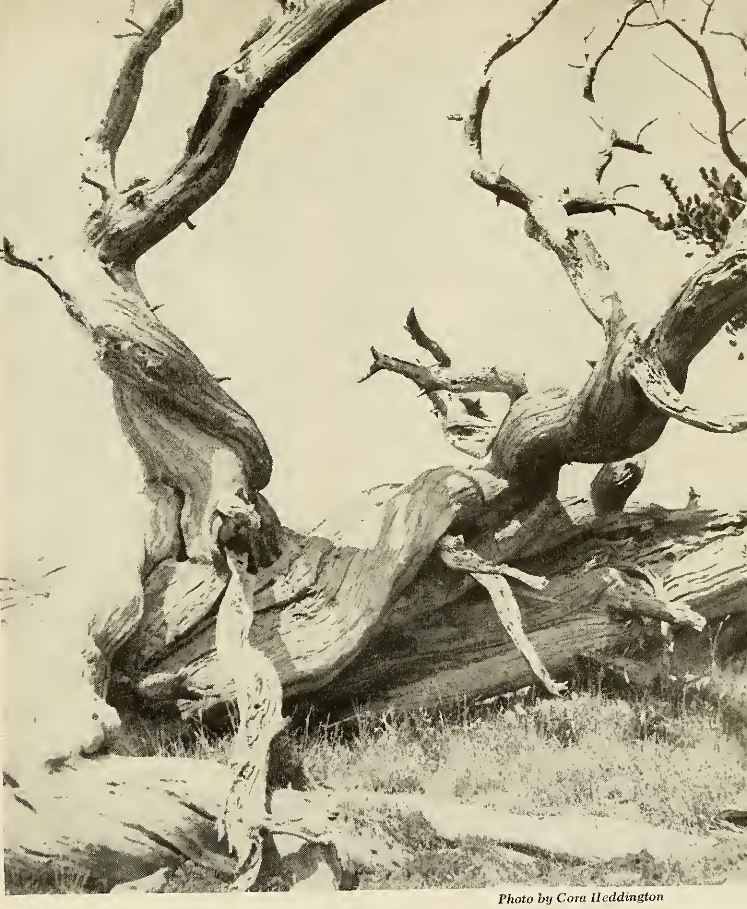


Photo by Cora Heddington

▲ **Spiral grain** is sometimes exaggerated into tortuously twisted forms like this at timber line. A tree on Mt. Evans, in Colorado

Do they reflect the spin of the earth, or the effect of strictly local influences? For centuries, people have wondered—particularly the lumberman, who is cheated by their corkscrew grain

By Paul M. Sears

THE homesteader came originally from the plains—from "treeless Texas," as he called it. Here in western New Mexico piñon pines stood around his dry-land farm in a neat open woodland. Trees were good to have about, the homesteader agreed, but these piñons were a sad disappointment. "You can't split 'em," he complained. "The grain twists around like a corkscrew. You start a clean split at one end of the log, and next minute you're hacking into it right *across* the grain. Why they have to grow that way, I don't know."

Neither does anyone else, including foresters who have tried hard to find out. The homesteader was up against a real mystery. Why do some individual trees, of many species and in many regions, grow with a truly mathematical spiral in the grain of their otherwise quite straight trunks? The question is not idle curiosity. Spiral grain, as the homesteader could testify, is usually an economic liability. More rarely, it can be an asset.

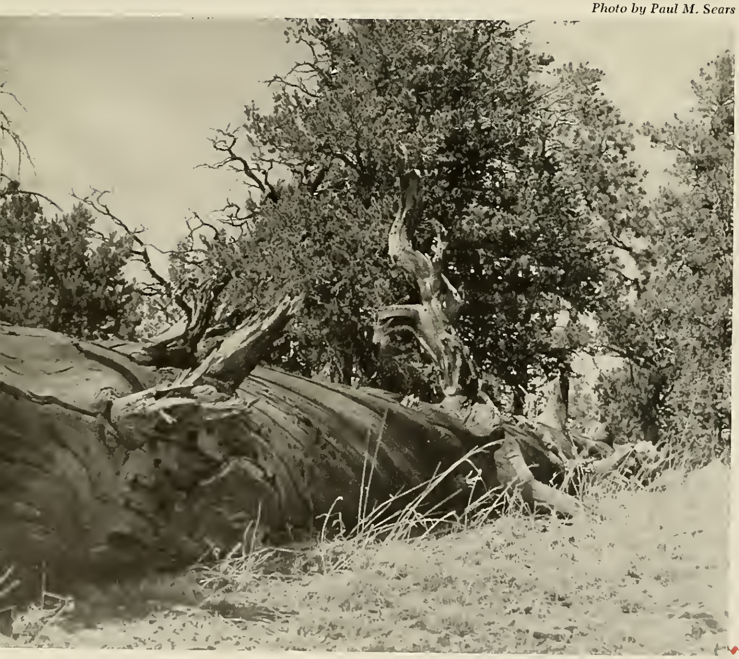
The spiraling of a stately tree trunk is beautiful in its natural geometry, but it is rarely noticed in living forests. Ordinarily only dead trees from which the bark is gone reveal the regular warp-lines winding upward around the trunk and out onto the larger limbs. In burned-over areas in the western forests, where standing, fallen, and half-recumbent dead trees await slow decay, the spiraling is so obvious that it can be measured by systematic surveys.

Thus one forester in Washington State counted 400 such trees in a sample area. All of them showed spiraled grain, making one complete turn, on the average, in about twelve feet of trunk length. More significantly, 96 per cent of them were twisted to the right. Likewise in a stand of alpine fir in Pike National Forest in Colorado, 85 per cent of the trees were twisted to the right. The gnarled apple trees in old orchards, to take another example, are spiraled almost invariably to the right.

This predominance of a rightward twist raises the interesting question of whether trees in the Southern Hemisphere might not be expected to twist mainly to the left. There are some reports that this is so; but unfortunately for the theory, the evidence in our own hemisphere is not consistent: a stand of Douglas fir in coastal Washington near sea level showed twisted grain in only 25 per cent of its individuals, and these were mostly spiraled leftward. Furthermore, among hardwoods, spiraled maples turn mostly to the right, but elms, though usually straight grained, turn predominantly to the left when they do spiral.

Thus we may be reasonably sure that spiraling is something more than a response to the pervasive forces of the earth's rotation. It seems to occur most often where stony soil or harsh climate gives the tree an uphill fight for survival.

Photo by Paul M. Sears



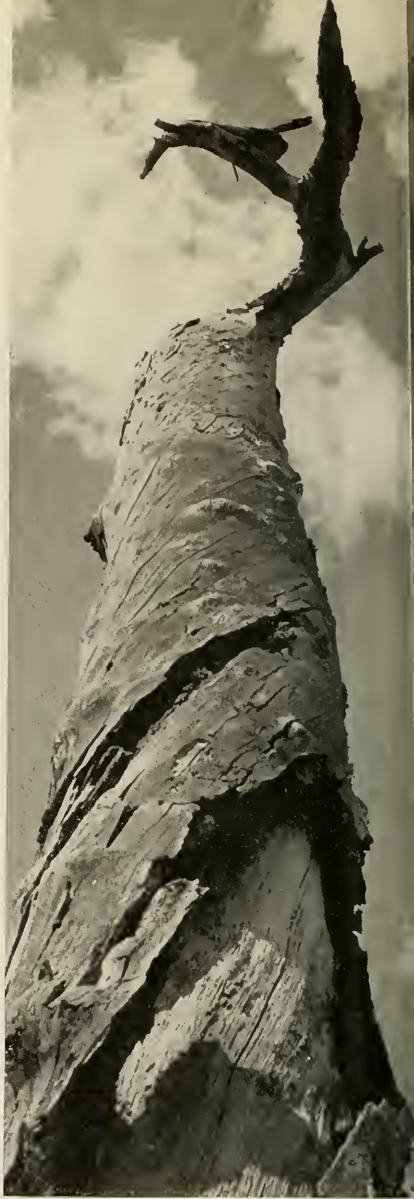


Photo by Paul M. Sears

▲ **The standing remnant** of a once-great ponderosa pine

◀ **Many a twisting tree** conceals its spiraling grain until the bark falls off, as in the case of this fallen ponderosa pine trunk in the Zuni Mountains of New Mexico

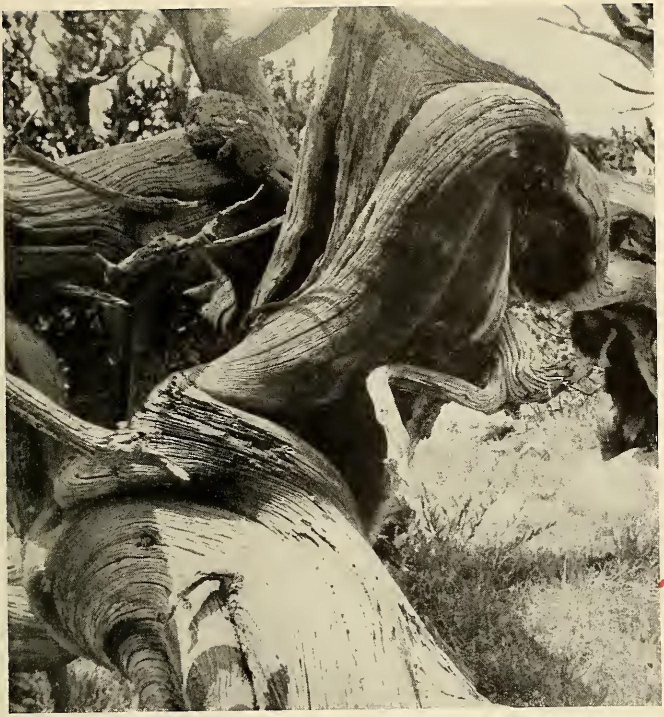


Photo by Cora Heddington

▲ **This intensely twisted tree** at timber line on Mt. Evans shows how complicated the spiraling can become when the branches also are involved

Single trees growing in exposed sites are generally more "tightly wound" than protected individuals growing in near-by forests. Spiraling, once started, grows more intense as the tree grows older.

The contorted tree-forms at timber line in the Rockies are intensely though irregularly spiraled. Not too far below timber line the high altitude forests are composed of trees with fine straight trunks, and here nearly every tree in some stands may be neatly spiraled. Certain high altitude species, such as Engelmann's spruce and limber pine, are noted among foresters for their consistent spiraling.

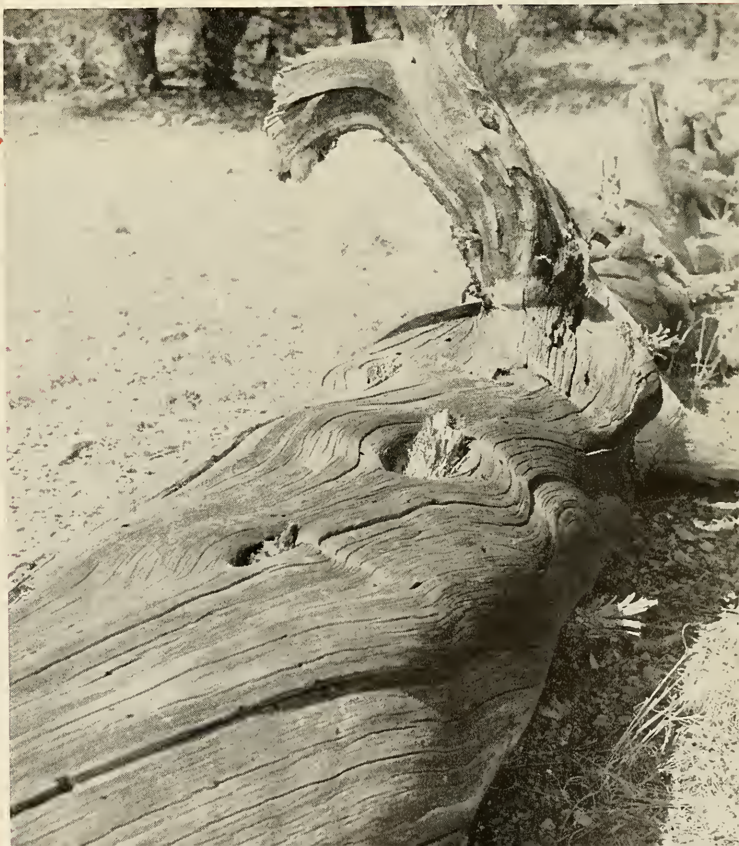
However, altitude alone does not control spiraling, for stands of Arizona cypress in the Coconino National Forest at an elevation of 4000 feet are as deeply twisted as spruce trees growing at three times that altitude. The twisting of Arizona cypress is often evident in the living tree, where the trunk may be fluted into ridges that twine upward around one another like compound candelabra stems.

The tendency to spiral seems to be partly hereditary. A few extreme cases are definite: for example, Scotch pine seedlings imported from northern Europe grow into useful trees in the United States, but seedlings of the same species from a locality in south Germany produce corkscrew-like trees—freak forms in which twisting affects the straightness of the trunk as well as the grain. Here, two hereditary races of Scotch pine clearly exist.

Because of suspected hereditary factors, foresters in charge of re-

▼ **Knotholes** interrupt the regularity of the spiraling grain in this ponderosa pine

Photo by Paul M. Sears



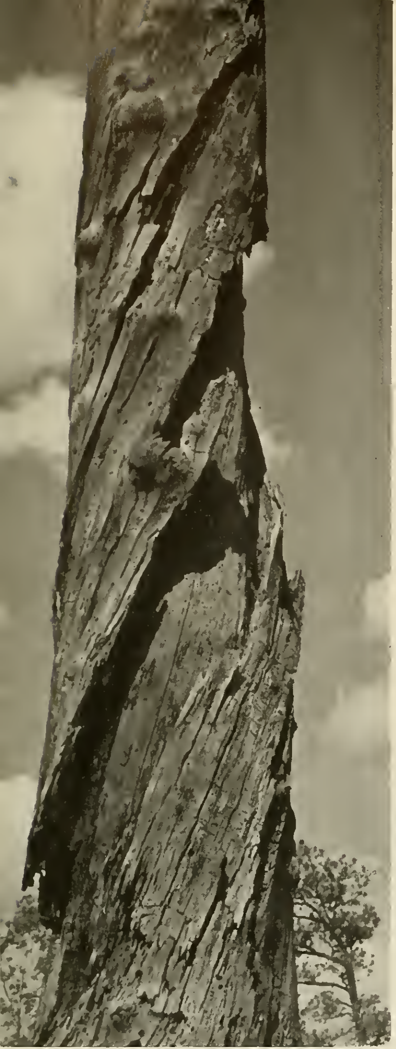


Photo by Paul M. Sears

▲ THIS TREE, 24 inches in diameter at the ground, made a complete turn in 12 feet of trunk length. Where the sapwood has partly decayed, the heartwood shows that the tree spiraled less rapidly when younger. A ponderosa pine one-half mile west of the Continental Divide in the Zuni Mountains of New Mexico

seeding projects try to select seed only from unspiraled trees. This may require cutting into the inner bark of the living seed tree to determine the direction of grain, although in some species, such as Douglas fir, spiraling is often suggested by the trend of the outer bark-ridges.

The desire to propagate straight-grained trees is born of the troubles that spiral grain inflicts on those who would use the timber. Lumber from trees with spiral grain, quite understandably, tends to warp as it seasons. And for structural uses spiraled timber is weaker than straight-grained timber. The degree of weakness depends on the tightness of the spiral; in extreme cases the grain may make a full revolution in as little as two feet of trunk length. One inch of deviation in twenty inches of trunk length is objectionable in structural work, and much more may be disastrous.

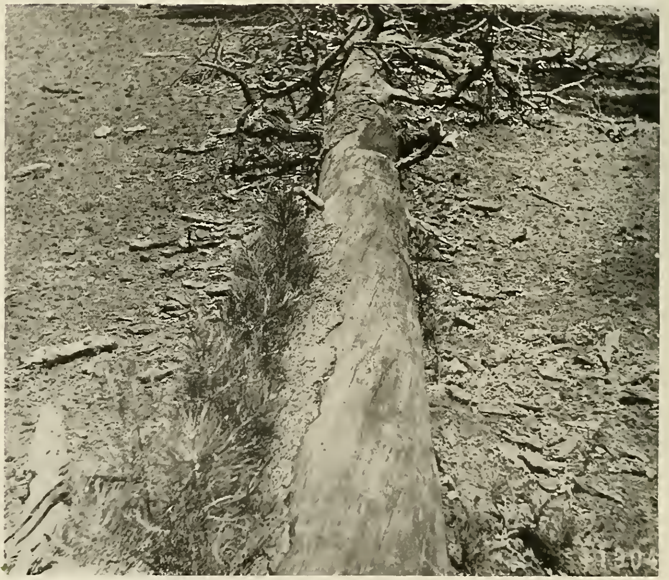
Spiraled timber may also split or shatter to pieces in machining operations; Douglas fir and hemlock are particularly bad in this respect. Further disadvantages occur when a long plank from a spiraled tree is planed. Some roughness in the finished board is inevitable, because no matter how the plank is cut, some of its surface will lie across the grain. Fortunately, the softer woods such as ponderosa pine stand sawing and planing quite well in spite of twisted grain, and furnish lumber that can be used wherever strength is not required.

Commercial lumbermen are not the only sufferers from spiral grain effects. The Indians living near Lake Kahnipiminanikok, in Ontario, make their canoe paddles from cedar. The grain must be straight to serve this purpose, and though abundant stands of cedar are available, the trees are nearly all of twisted grain.

It is good to report, by contrast, that occasionally spiral grain has been a providential blessing to man. Notably, the rural plowmakers of colonial America needed, and eagerly sought, the rare hardwood trees of the eastern forests that had a leftward-twisted grain. Such timber accommodated itself naturally to the shape of the moldboard. The tighter the spiral the happier was the plowmaker, for then the plow would not be weakened by cross-grain cutting needed to finish the close curve of a moldboard.

The ultimate complexity of spiral grain appears in some of the tropical hardwoods such as mahogany, which exhibits an "interlocking"

U. S. Forest Service photo



➤ WHEN CLOTHED in bark, it might have looked like a good timber tree. Recumbent, its greatest service is as "nursemaid" to the row of seedlings springing up along one side grain. Here the direction of spiral is varied from right to left several times during the life of the tree. Such timber is difficult to work, but the effort is rewarding, for these are the exotic woods of the fine cabinetmakers, who prize in their finished pieces the beautiful figure of grain resulting from the alternating spiral.

Many of the strongest and toughest timbers of tropical Australia are heavily interlocked in grain. The karsi *(Eucalyptus diversicolor)* may grow with either straight or interlocking grain, the latter structure producing stronger timber. The maple silkwood of Queensland, when milled, produces a light brown to pink lumber, and the grain may be wavy or curly but is most often interlocking. This jungle tree is one of the best cabinet woods of the world and is a favorite among Australian furniture makers. The grain of some of these tropical Australian woods may interlock at nearly 90 degrees in extreme cases.

Fortunately, you don't have to visit a remote and ruined forest to observe spiral grain; some of the telephone poles in your vicinity are likely to show spiraling. And if you burn seasoned logs in your fireplace, pull the bark away from a few of them. You may uncover a section of one of Nature's barber poles.

THE DESCENT INTO THE BARRANCA DEL COBRE

Continued from page 445

We moved forward once more on the twelfth, following the torrent, although there appeared no possible way it could pierce the mountain wall ahead. Suddenly the stream turned and dashed at a huge rock, which blocked the view of the mountains beyond. It swung to the right and around the base of the rock. We followed. At the moment of turning, my mule reared backward. And no wonder! Instead of a mountain climb ahead, we were standing on the dizzy edge of a huge canyon, right across our course!

The torrent plunged straight downward into a series of waterfalls for 1500 feet. It was now a raging cataract which roared down the cliff, while the flung spume drifted into the gulf below, a thousand tiny rainbows riding on its spray. The dim trail zigzagged down the hazardous slope, which seemed unnegotiable for mules.

Juan said that the canyon, the Arroyo Hondo, extended miles to the right and left and there was no trail to get around it. We must get across it, and the Barranca was still four days away. Both Paul and Tommy were feeling much better, however, and voted to proceed. I sent Jim and Juan part way down the "zigzag" to see if it were negotiable, for there might be no turning back, with 20 animals.

Jim reported it to be dangerous with uncertain footing, but he thought we might make it. Also, we could turn around at one point. So down we went, our animals sliding most of the way, with the ever-present danger of starting an avalanche. It was a happy moment when we reached the bottom. Since we had started at sunrise, it was now only about 10:30 in the morning, and we paused for a bite to eat. Juan claimed there was a poisonous plant in the stream which would kill the animals, so we hobbled them.

The floor of the canyon was flat like the Yosemite, ½ mile wide, and covered with a magnificent primitive forest of pines, firs, and cedars, untouched by ax or machete. Some of them were 6 feet in diameter and 150 feet in height. Deciduous trees resembling beeches, alders, and even maples appeared in scattered clumps. On the north side the walls were sheer cliffs and ledges, very different from the south slope we had descended. I later found debris from floods at the mouths of caves 50 feet above the normal level of the river; so Jim was correct in his estimation of the terrific power of flash storms in this region. In bushes below the caves I collected a thrush with a bright orange lower bill. It became the type specimen of the Olive-winged Nightingale Thrush[3] which I later described as new to science.

That night, I was awakened by a hoarse, breathy sound, which startled me into thinking a jaguar was preparing to leap. Whirling our giant collecting flashlight on the trees at the base of the cliff, I could locate no animal. Later I was aroused again by a frightening bedlam of growls, coughs, and shrieks such as I had never before heard, emanating from the top of the cliff. It awoke Tom, and he called that it was a large owl! During the following year the type specimen and two other examples of a very rare Stygian Owl were secured by my collector, Chester C. Lamb, in this same mountain range 100 miles to the south.[4] A few months later at the United States National Museum, I imitated its calls to Dr. J. H. Riley and was assured by him that they must have come from a Stygian Owl, as he had heard the same queer sounds from its nearest relative, the Santo Domingo Stygian.

As it was still early afternoon, I decided to essay the climb out of the canyon to Guayachi, where Juan assured us we could obtain tortillas for our *cargadores.* They were growing increasingly surly because we could not produce fresh ones every morning. We soon found ourselves puzzled by a maze of forking canyons. Even Juan lost his way and caused us to retrace our steps, with the loss of two hours time. I did not blame him, for in many places all traces of a trail had been washed away by floods. We finally emerged on a plain covered with pines, where we were assaulted by a truly magnificent thunderstorm that stung us like hail for two hours. Soon ponchos were leaking, and even the mules flinched at the terrific beating. We were glad to reach Guayachi, a small Tarahumare farmhouse in the middle of plowed ground. Cold from the icy ponchos, we hovered over a wood fire on the dirt floor.

The rain ceased, and an ancient Tarahumare told a story of many *guiculos* (wild turkeys) behind the mountain to the east. His offer to prove it at once meant that the day had just begun for me. Never was I so deceived by the deep furrows of an Indian's face. Judging he was at least seventy-five years of age, I imagined I would have no difficulty keeping pace with him, but the Tarahumares are noted for their stamina.[5] He gave me the severest "hike" I ever experienced. It was actually a continuous dog-trot without letup for two and a half hours—down hillsides, over small slippery rocks, or up shalelike slopes covered with treacherous pine needles. If I begged him to halt so I could recover my breath, he would grunt and go all the faster. He wore crude leather *zapatos* tied with deer thongs between his toes. Clearly he despised me! With tongue hanging out of my mouth and heart thumping, I missed a magnificent cock turkey but made a flopping mass of feathers of a female. As I put in a new cartridge, she got on her feet, however, and ran down the hill at great speed. The ancient guide never moved. Obviously he was afraid to run down that slippery hill on his *zapatos!* I decided to take the chance and leaped down at full speed, and I finally secured the turkey. When I returned with her, the Tarahumare let out a curious cry and flung himself into a gnomelike clog dance. Then he rushed up and patted me on the back with many grunts of approval. Evidently I had redeemed myself. But I had an additional reason for excitement. That turkey was another bird new to science! It is now the type specimen of *Meleagris gallopavo onusta.*[6] Heavy rain made us thankful we had raised a tent over our supplies that night.

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[3] *Catharus aurantiirostris aenpennis* Moore (Proc. Biol. Soc. Wash., vol. 50, p. 96).

[4] The author described the new race, *Asio stygius lambi,* in the Proc. Biol. Soc. Wash., vol 50, p. 103.

On the thirteenth, in spite of a threatening thunderstorm, we decided to move on to Chiricahui, from where we might reach the Barranca del Cobre in one long day's safari.

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[5] See "The Tarahumaras — Twentieth-Century Cave Dwellers" by George McClellan Bradt, in NATURAL HISTORY for November, 1948.

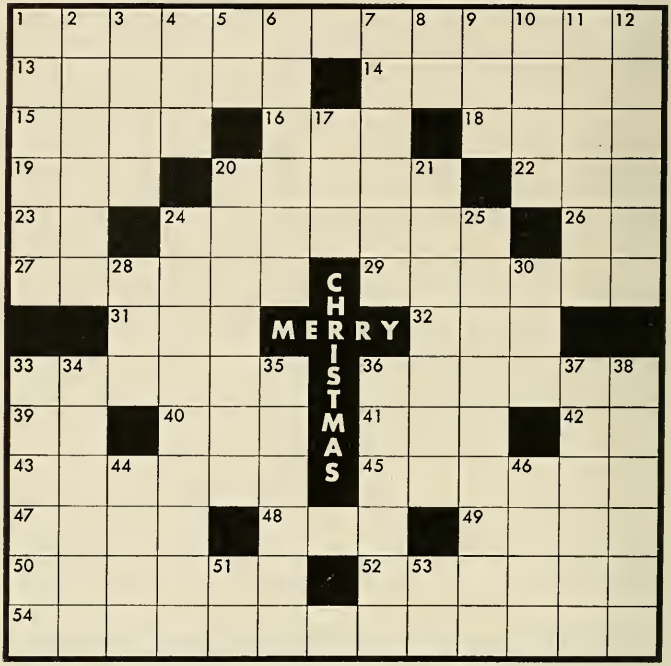
[6] *Auk*, vol. 55, Jan., 1938, p. 112.

(The remainder of the story of the descent into the Barranca del Cobre will be published in the next issue of NATURAL HISTORY.)

Nature Crossword Puzzle

BY ALFRED I. TOOKE

Sharpen up your wits, polish up your brains
And get out your dictionary;
Though some of the words are easy to guess,
Some are quite the contrary.



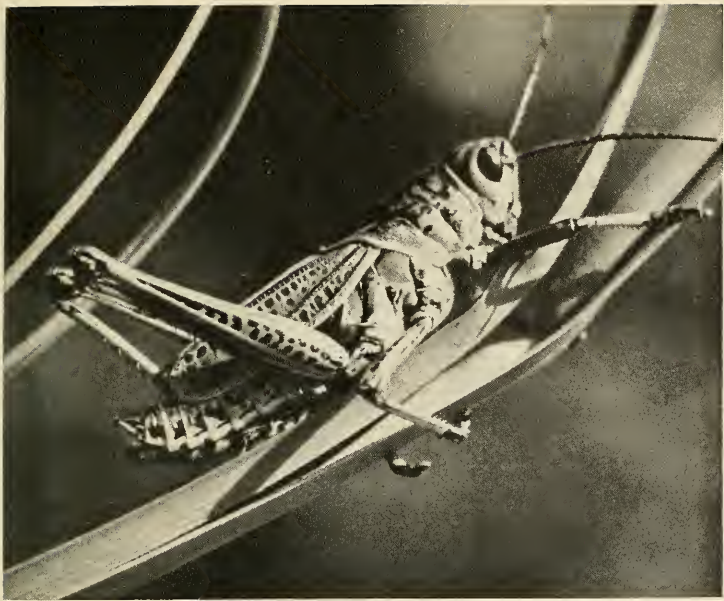
ACROSS:

1. Reptile expert.
13. Rabbit-sized rodent of tropical America (*Dasyprocta*).
14. Inflame with love; charm; captivate.
15. First stomach of a fowl; the craw.
16. Man's best animal friend.
18. Agile, active.
19. Carrion.
20. Any tree or shrub of the genus *Alnus*.
22. The iris.
23. Lieutenant (abbr.).
24. Combed and trimmed with the beak.
26. Missouri (abbr.).
27. A valuable domestic animal found wandering from its owner.
29. One of the Doric race.
31. Member of the Women's Army Corps.
32. Floating water-lily leaf; cushion on cat's foot.
33. A bell jar to protect a plant.
36. To request with authority.
39. Railway (abbr.).
40. Very small bird; also small horse.
41. Suffix used in Latin or Latinized names of groups of animals.
42. Each (abbr.).
43. Something unjudged or undecided (Obs.).
45. Pertaining to the stars.
47. Bluish-white metal in common use.
48. Kind of dirt frogs like.
49. Ninth letter Greek alphabet.
50. Endow with a halo.
52. Time rabbits lay fancy eggs!
54. Instruments for measuring declination of magnetic needle.

DOWN:

1. The neck plumage of the domestic fowl.
2. A heron with white plumage.
3. Part of tree or plant underground.
4. Baby dog.
5. Diminutive suffix.
6. A wren.
7. A fable or myth.
8. Upon.
9. Neither a solid nor a liquid.
10. Mischievous children.
11. A mass of carpels forming a compound pistil.
12. A sting ray.
17. Short poem or song.
20. Genus of food plants that ripen their fruit underground, like the peanut.
21. Opens again.
24. Capable of active use.
25. Playwright.
28. Twice the number of eggs a passenger pigeon always laid.
30. Zoology suffix terminating names of animal groups; also girl's name.
33. Driven insane.
34. Chemical compound derived from boxthorn.
35. Original word root or primitive word.
36. Crown.
37. Tidier.
38. Polish thalers.
44. Royal Naval Hospital Corps (abbr.).
46. Repetition as a method of memorizing.
51. This number written in Roman style.
53. First two vowels.

Solution on page 476



Harrison M. Reed, Jr. photo

◄ AN ADULT LUBBER LOCUST, which uses its wings for talking instead of flying

The Lubber Locust

It is probably the largest member of the grasshopper family in America

By HARRISON M. REED, JR.

THE Lubber Locust, *Rhomalea microptera,* is a pest that farm and home gardeners alike must contend with clear across the southern states and as far west as the Texas border.

Females have a body length of about three inches. With legs and antennae extended, they might measure four and one-half inches. The females seem to outnumber their consorts in a ratio of five to one.

Lubber locusts are often seen walking with an amusing but stately gait across our southern highways during the warmer months, leaving one field of destruction to conquer newer territories. Having a ravenous appetite, they cut their way through the tender parts of plant life, leaving the injured remains behind them, for they are ever on the move. Not content to remain and eat one plant, these giant insects can lay low the choicest row of your garden in a single day. However, there are other grasshoppers that are worse.

Although the lubber locust has wings, it cannot use them for flight, for they are inadequate to support the insect's weight. But nature has given them another use, that of sending and answering the mating call. Under the hard, plastic-like wing cover is a delicately colored pink and red wing that is part of a sound system. The familiar "chit-chit-chit-chit" of a summer day throughout the southland should move the garden and flower lover to search out its origin at once and kill the insect. The male calls in a higher key than the female, because his wings are shorter. The insects hear each other as much as several hundred yards apart and head toward each other, eating ravenously as they go. The lubber locust also makes a hissing sound, by forcing air from the large stigmata near the base of the wings.

The male and female have similar markings and colorings, but the male is much less brilliant. The female is buff-yellow with black markings, and her head, cape, and wing covers are bright red filled in with sunset orange-yellow. Many, however, are nearly black, particularly those north of Florida.

The female lays several batches of eggs in a season, placing them just beneath the surface of the ground, usually in sandy loam, beside some plant that will afford the young their first food the following spring. The eggs are yellow and about the size of large grains of cooked rice.

The young, ranging from 25 to about 60 in a single colony, emerge as tiny black grasshoppers with a bright yellow stripe extending from their cape to the tail end. They display a very interesting habit in their gregarious inclination to move as a body. At dusk, they will be seen to climb the nearest grass blade or weed to roost, all facing upward. Then at daybreak, before it is quite light, they turn in unison and walk down the stem to begin their day's wanderings. At this stage, early in the morning, it is quite easy to tap them off into a pan of kerosene. The wary gardener will save himself much grief if he does this for several mornings, until most, if not all, of the insects have been destroyed.

Under favorable climatic conditions the lubber locust has been known to reach plague proportions. Anyone who has observed one at work gains some idea of what an army of them could do. So, if you love flowers or want to protect the vegetables in your own or your neighbor's garden, kill the lubber locust. He is no friend.

BOOKS

Continued from page 439

There are also 65 smaller, frequently charming sketches of birds, flowers, mammals, and frogs.

More than any other contemporary painter of birds, Menaboni has been influenced by Audubon. The same love of birds in action is evident in the work of both. Menaboni has avoided the excesses occasionally to be found in the paintings of his predecessor but in doing so has allowed his own style to become a bit too facile and polished. His birds have not a feather ruffled; their wing quills in flight stand revealed in the minutest detail, as though caught by the eye of a superspeed camera, not by the human eye. Sleekness becomes a dove, but not an eagle. But this is a comparatively minor fault. Menaboni has a fine eye for composition, and many of his arrangements of small birds among foliage are very beautiful.

The text, which runs to 75,000 words or more, tells in somewhat rambling fashion of the experiences of the Menabonis with birds and of the many pets they have kept as models for paintings. This narrative would have profited by condensation and revision. There is also a short biography of the artist and his wife by "J. S.," who is apparently an official of the publishing firm.

Menaboni's Birds will make a handsome addition to any home library. The great cost of manufacturing colored plates in this country today made its high price inevitable.

Dean Amadon

Solution to Nature Crossword Puzzle

H	E	R	P	E	T	O	L	O	G	I	S	T
A	G	O	U	T	I	■	E	N	A	M	O	R
C	R	O	P	■	D	O	G	■	S	P	R	Y
K	E	T	■	A	L	D	E	R	■	S	E	G
L	T	■	P	R	E	E	N	E	D	■	M	O
E	S	T	R	A	Y	■	D	O	R	I	A	N
■	■	W	A	C	■	■	■	P	A	D	■	■
C	L	O	C	H	E	■	D	E	M	A	N	D
R	Y	■	T	I	T	■	I	N	A	■	E	A
A	C	R	I	S	Y	■	A	S	T	R	A	L
Z	I	N	C	■	M	U	D	■	I	O	T	A
E	N	H	A	L	O	■	E	A	S	T	E	R
D	E	C	L	I	N	O	M	E	T	E	R	S

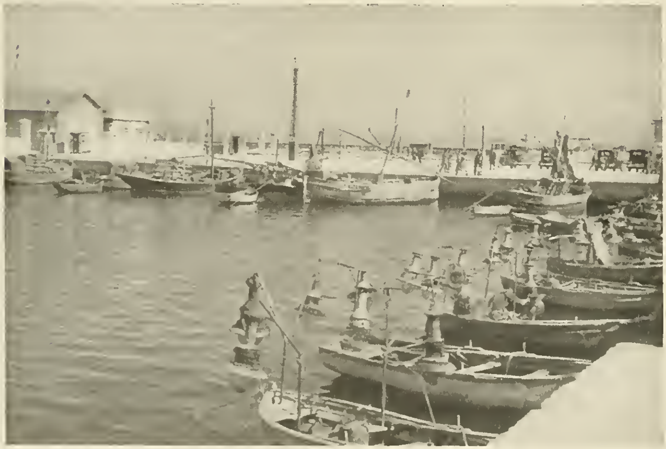
LETTERS

Continued from page 434

ican Museum's Department of Animal Behavior:

Wild birds are not likely to lay unfertilized eggs. Egg production is controlled primarily through the activities of the ovary and indirectly by hormones secreted by the pituitary gland. The functioning of the pituitary gland depends to a considerable extent upon various climatic conditions and, secondly, upon a series of behavioral acts commonly known as courtship. During the courtship period females are generally mated and inseminated. Later, when eggs are produced by the ovaries, sperm await them in the oviduct and the eggs are fertilized. If the courtship process is interrupted to the extent that the birds are not inseminated, then it is likely that the ovaries will not be sufficiently activated to produce eggs. Moreover, as soon as a clutch of eggs is laid, the female begins to incubate them, and she becomes broody. This broody condition inhibits further egg production by the ovary. To maintain egg production, as all poultry breeders are aware, the eggs must be collected regularly. Among certain species of wild birds, prolongation of egg production has been induced by removing the eggs as soon as they are laid. For example, a flicker was induced to lay 71 eggs in 73 days. Since the sperm are not likely to remain viable for this length of time, it may be possible to obtain infertile eggs in this manner.

During the process of the domestication of the fowl, breeds have gradually been developed that require less and less courtship behavior to stimulate ovarian activity. Among present-day fowl, a rooster is not necessary to build up or maintain egg production in the hens, and the latter will continue to lay even in complete isolation. In former years it was of definite advantage to the poultryman to be in possession of broody strains because of their ability to incubate a large number of eggs. Now, with the advent of mechanical incubators and chick-rearing devices, this maternal behavior is not only superfluous but a clear disadvantage, since egg production is temporarily suspended. By vigorous selection practices, broodiness has been all but eliminated in the white leghorn.



Fishing with Lights

Sirs:

The discussion on catching fish by artificial light in the October issue of Natural History brings to mind what I observed in Algeciras, Spain, last spring.

The accompanying picture shows the fishing boats that fish in the straits of Gibraltar every night. You will notice that each is fitted with a battery of powerful gasoline lights. I was told that for a considerable period of time, this has been the only means by which successful fishing in the straits could be carried on.

While on the subject of fishing, I noticed an oversized tug equipped with a harpoon gun in the bow, and was told that the straits furnished good whale hunting.

Ottumwa, Ia. George M. Foster

Corrections

The two captions referring to a shrew and a field mouse at the bottom of pages 400 and 401 in the November issue were inadvertently transposed.

In a letter in last month's issue, Mr. J. M. Hollister told how a fish had been taken off the hook by an owl. Between the time when the story left Mr. Hollister's honest care and when it appeared in print, the fish mysteriously grew from ten inches to ten pounds!

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January

NATURAL HISTORY

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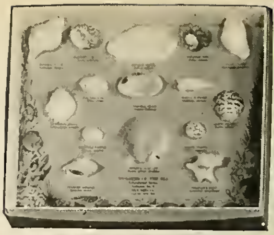

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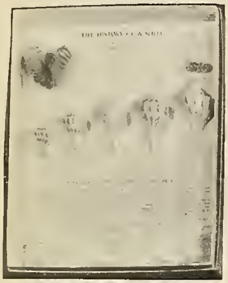

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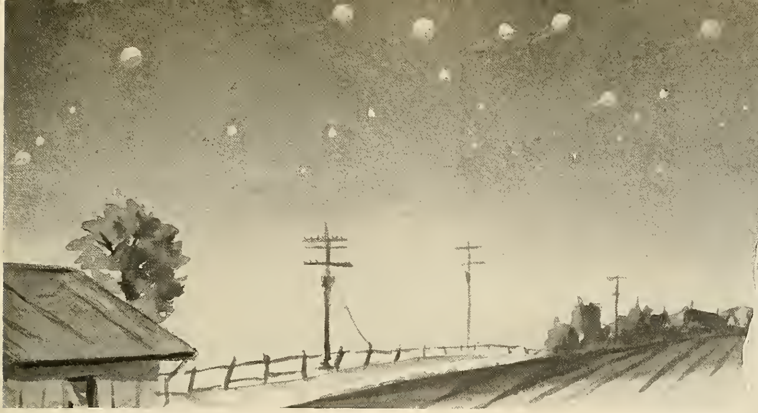
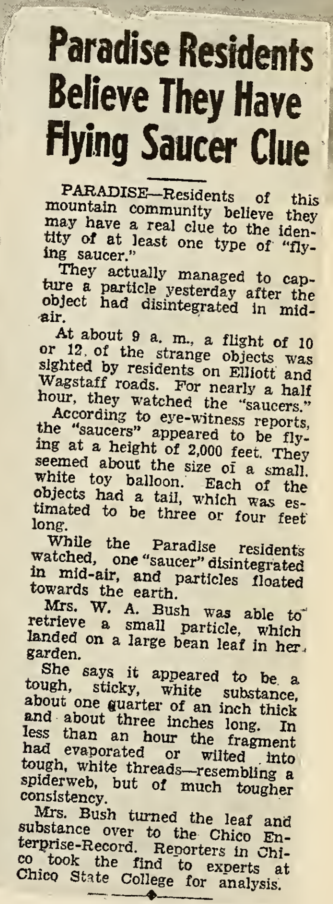


Those Things
in the sky

A spectacular display of "flying saucers"— and the equally astonishing explanation

By W. H. Hutchinson



Paradise Residents Believe They Have Flying Saucer Clue

PARADISE—Residents of this mountain community believe they may have a real clue to the identity of at least one type of "flying saucer."

They actually managed to capture a particle yesterday after the object had disintegrated in mid-air.

At about 9 a. m., a flight of 10 or 12 of the strange objects was sighted by residents on Elliott and Wagstaff roads. For nearly a half hour, they watched the "saucers."

According to eye-witness reports, the "saucers" appeared to be flying at a height of 2,000 feet. They seemed about the size of a small, white toy balloon. Each of the objects had a tail, which was estimated to be three or four feet long.

While the Paradise residents watched, one "saucer" disintegrated in mid-air, and particles floated towards the earth.

Mrs. W. A. Bush was able to retrieve a small particle, which landed on a large bean leaf in her garden.

She says it appeared to be a tough, sticky, white substance, about one quarter of an inch thick and about three inches long. In less than an hour the fragment had evaporated or wilted into tough, white threads—resembling a spiderweb, but of much tougher consistency.

Mrs. Bush turned the leaf and substance over to the Chico Enterprise-Record. Reporters in Chico took the find to experts at Chico State College for analysis.

◆

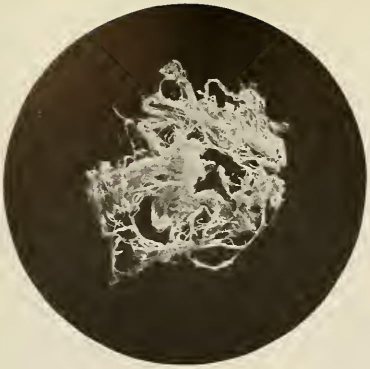
WE live in the Sierra Nevada foothills of California, in the Cohasset district of Butte County, at an elevation of 2900 feet according to the topographic map of our quadrangle. We are twenty miles from the nearest Sacramento Valley town, our nearest neighbor is two and a half miles away, and we have no telephones, thank God! We are even farther removed, or so we thought, from the current uneasiness about interplanetary discs, sixteen-inch men from the Outer Galaxies, and atomic strikes by enemies of the United Nations. I think that my wife and I are people of intelligence and good reason. Our two boys, aged five and six plus, go to school at home via the Calvert course and are perfectly normal little hellions with 160 second-growth acres for their domain. This background seems essential to an appraisal of our recent visitation from the skies.

At 10:40 in the morning of October 11, 1950, Bee-Boy, the younger, came pelting into the house and up the stairs to my study with tears streaming down his face and fear sobs choking in his throat. The sky was filled with strange white objects that did not come down, that made no sound, and that went overhead too high and too fast for him to comprehend. It was the lack of sound, of the reassurance brought by noise, that seemed to matter most. He was so obviously panicky that I left my work and went with him to see these things, cursing every radio program, funny paper, comic book, and careless conversationalist that had ever entered our house. My wife, red-headed and competent, had already joined Jamey in the field that runs up behind our house, to the dense second-growth red fir, ponderosa pine, and incense cedar that rings our clearing. She had already seen the *Things,* and so did I as soon as I got the sun behind me.

At all elevations, from 100 feet above us to the blue empyrean, literally hundreds of shining silvery-white balls were speeding in a general northerly direction. Before our eyes, they divided and formed connected V's of two, three, and more globular objects that kept on their previous course. They could disintegrate or otherwise disappear before our eyes without a sound, seemingly with a trace of light blue smoke or vapor lingering for a moment to mark their end. One did come down almost to ground level, and as we ran to catch it, it suddenly spurted up above the treetops and disappeared as though some radar-like antenna had warned it of disaster. Other than the directional undulations of their long tails, the objects seemed solid and about the diameter of a dinner plate. They also seemed to have a common directional pattern and a happy faculty for evasive action.

The day was golden clear. There was not a cloud in the sky, and a strong fresh breeze was blowing from the south, a customary direction under normal barometric pressures in our locality. The day was warm, even for California in October, and the local press was referring to the "unseasonal" heat wave. The foothill oaks and bearberry and dogwood were turning color in the woods around us. God was in His Heaven, and all seemed right with our world; and there was undoubtedly a rational explanation for what we were seeing. But I am quite sure that I know now exactly how *Homo Heidelbergensis* regarded the Unknown beyond the fireshine at the cave mouth.

My wife advanced the hopeful theory that they were ash particles from a brush fire we knew was burning away off down the ridges to the south. This was a comforting thought, since a forest fire is a known quantity, but ash never travels hooked together in formation. Neither does ash survive long mileage in particles as large as these refulgent objects. Two planes had passed over just before the boys spotted the first of these white flyers, and they were willing to settle for parachutes, now that their parents were sharing their experience. Their parents thought perversely of balloons that could travel from across the Pacific with a deadly cargo. Vagrant weather balloons, jettisoned ping-pong balls from a onetime transoceanic plane, and anything else suitable to explain what we could not explain was considered and discarded.



◂ WHAT was left when one of the *Things* hit a tree (about actual size)

We spent an hour observing our space travelers without reaching a solution as to their identity. Whatever they were, there were lots of them. We came indoors for luncheon, and the traffic had slacked off by the time we went outside for another look. By evening, they were not in evidence. We had spotted no forest fires near by; if radiation was going on, we did not feel it, and if little men were creeping up on us through the brush, our dogs could not detect them. We could not explain the phenomenon and locked our minds against that fact in self-defense.

Next morning, a mass of sticky, gauzy stuff was caught in a fir tree near the house. My simple mind recalled a recent book review covering the order Araneida, in which it said that certain spiders are known to climb upon a stump or large rock or whatever, weave a sail, and hop off bent on migration, thermally assisted. As far as I am concerned, that is the explanation of our visitation. In this day and age, a little knowledge of natural history can be comforting. I only hope it does not lull me into a false security. From now on, silvery objects in the foothill sky are transient spiders.

In an envelope accompanying this material I am sending the gauzy stuff that was collected in the evergreen tree. Perhaps the scientists at the American Museum of Natural History can analyze it and tell us what it is.

* * *

Dr. Willis J. Gertsch of the Museum's Department of Insects and Spiders reports as follows: "The material is, as Mr. Hutchinson deduced, spider threads, otherwise known as gossamer. Great showers of gossamer have fallen in many places in the world, and fantastic interpretations have been given in the effort to explain this. The true explanation is quite simple.

"Soon after hatching many spiders have the inclination to climb upward toward the sun and to throw silken threads out upon the soft breezes. This urge toward ballooning is surely one of the most extraordinary accomplishments of the spider. Once the spiderling has reached the highest point, it turns its face toward the wind, extends its legs to their fullest, and tilts its abdomen upward. The threads of spider silk are drawn out by the air current, and when the pull on them is sufficiently strong to support the weight of the spider, it lets go and is pulled into the air. It is presumed that some of the spiders actually exercise some control over their flight by pulling in, winding up, or streaming out more filaments.

"Individuals have been known to travel as much as 200 miles in this way without coming to rest. Flying is not solely the province of the baby spider, for spiders of all age groups, limited solely by size, indulge in the sport over much of the year. However, during the autumn months in temperate areas spiders become very active, and, either in unsuccessful attempts to balloon or for other purposes, they cover the meadows and shrubbery with innumerable threads, which soon form a thin webbing over everything.

"The Yosemite Valley in California is famous for its occasional dense accumulations of gossamer, and Mr. Hutchinson's home may be in a similarly favored area. In Yosemite, the shrubs, bushes, and trees are said to become so webbed that the trunks of the largest trees are but faint shadows, while limbs and foliage resemble a glistening mass of crystal. A sudden wind is able to dislodge portions of the material and to carry it into the air. Mr. Hutchinson and his family must have seen an unusually fine display of air-borne spider silk. The same explanation no doubt applies to the 'flying saucers' mentioned in the accompanying newspaper clipping from the Chico (California) *Enterprise-Record*, apparently reporting the same event."

NATURAL HISTORY

The Magazine of the American Museum of Natural History

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VOLUME LX—NO. 1
JANUARY, 1951

Grand Canyon...Cover Design
From a color photograph by Jack Breed

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This spectacular cascade swings open the gates to one of northern California's least exploited wonderlands

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It looks like a fruit tree but acts like a fence

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THE COVER THIS MONTH

The Grand Canyon of the Colorado, featured on this month's cover, provides a thrilling and colorful view from whatever point you see it. This particular scene was photographed by Jack Breed at Point Imperial on the North Rim, looking down into Nankoweap Basin in the eastern end of Grand Canyon National Park.

The jagged pinnacle in the center foreground is named Hayden Butte or Hayden Mountain in honor of Charles T. Hayden, an early pioneer in Arizona, who arrived in 1857 on the first overland stage to reach Tucson. The butte towers 5639 feet above the Colorado River at this point and rises a total of 8350 feet above sea level.

Grand Canyon National Park, established by Act of Congress in 1919, contains 1008 square miles and includes 56 miles of the Canyon's 280-mile length. The gorge varies in width from four to eighteen miles, and its depth is over a mile in many places. Covering the North Rim, where this picture was taken, is the beautiful Kaibab Forest, which helps to accent one of America's most sublime spectacles.

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for the student and collector

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THE REPTILES AND AMPHIBIANS OF SOUTHERN AFRICA

- - - - - - - - - - by Walter Rose

Maskew Miller, Ltd., Cape Town, 30/
378 pp., 214 photos

PRESUMABLY it was some time in the early '20's that Dr. Walter Rose, a South African dental surgeon, embarked upon his hobby. Accompanied by his three sons, he devoted week-end outings to studies of the frogs, lizards, snakes, and tortoises inhabiting the vicinity of Cape Town. Little was known of the habits or life histories of many animals in this interesting region, a situation that Dr. Rose set out to remedy.

By 1929, he had assembled enough information, sketches, and photographs to prepare *Veld and Vlei*, a book that contained a wealth of information gleaned from various sources, much of it based upon personal observation. Unfortunately, a fire at the publisher's establishment destroyed the bulk of the edition before many copies found their way to America.

Meanwhile, Dr. Rose continued his studies with unflagging interest. Gradually this expanded into a desire to produce a reasonably complete account of the amphibians and reptiles of southern Africa. The result is an enlarged and thoroughly readable description of an extraordinary fauna, which includes a frog that sometimes lays its eggs in damp earth, a tortoise that lays several times a season but deposits a single egg at a time, cobras with modified fangs that permit them to eject their venom into the eyes of the enemy, and a chameleon that is a poor climber and spends most of its time on the ground!

Dr. Rose has made a valiant effort to bring all scientific names up to date, a difficult feat with the nomenclature in a state of constant flux. Readers acquainted with the problem will pardon his inability to keep fully abreast of the changes systematists have indicated. Less pardonable are such misspellings as "axolytol" for "axolotl" and his confusion concerning the families of snakes. Such mistakes do not seriously mar the book, and American naturalists will find much of value and interest in the descriptions of unusual habits or life histories. Personal anecdotes and philosophical digressions, sometimes humorous or satirical, sometimes whimsical or even naïve, add to the charm of this unique book, by a man who has made the most of his hobby.

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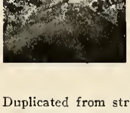
FISHING IN MANY WATERS

- - - - - - - - - - by James Hornell

Cambridge University Press
London and New York, $6.00
204 pp., 44 figs., 36 plates

THIS is a fascinating book, even to one who does not particularly care for fishing. The author has drawn on his long experience as technical expert on Fisheries for the Colonial Office of the British Government to give vivid descriptions of the varied fishing methods practiced in Africa, the Mediterranean, India, Ceylon, China, Japan, Melanesia, and Polynesia. He has observed most of the practices at firsthand, and the descriptions are vivid and entertaining to the general reader, as well as filled with the sort of detailed description that is so much valued by the ethnographer.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The volume is organized according to fishing techniques and industries, but the author has not hesitated to insert full chapters on subjects that have interested him particularly and on the methods of specific ethnic groups.

Two mild criticisms of this volume occur to me. Specialists who will want to make use of the wealth of detail will find the lack of a more formal organization a trifle disconcerting. This is explained by the fact that the volume has not been written for the specialist, and there is partial compensation in the index. The second criticism refers to the assumption, which the author makes in several places, that the simpler types of fishing gear necessarily preceded the more complicated devices. This is unwarranted, for history cannot be deduced from typological comparison alone.

Fishing in Many Waters is well written in an easy narrative style, and text figures clarify many of the descriptions. The 36 plates placed at the back of the volume are excellent.

James A. Ford

THE PLANET MARS

- - - - - by Gerard de Vaucouleurs

Translated by Patrick A. Moore

Macmillan Co., $2.00
87 pp., 5 plates, 5 figs.

FOR many years, men from Mars have been stock characters in science-fiction writings and in the comics. Now that we are entering the interplanetary age, interest in other worlds than ours has increased immeasurably, and M. de Vaucouleurs' excellent little book will be well received by laymen as well as scientists. Such intriguing questions as the possibil-

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ity of life on Mars, the truth about the Martian "canals" (are they proof of the industrious activity of the Martians, or are they nothing more than persistent optical illusions?), the physical conditions on Mars, and the possible explanations of the changes on the planet's surface as observed from the earth are discussed. The reviewer noted only several minor inaccuracies in the book; and until a larger volume is published, this excellent little book, bringing together concisely all that is now known about the planet Mars, will hold supremacy in the field.

Kenneth Heuer

INDIAN ART OF THE AMERICAS

------ by Le Roy H. Appleton

Charles Scribner's Sons, $15.00
279 pp., 79 color plates

AFTER the many excellent books that have appeared recently in the field of American Indian art, Mr. Appleton's contribution is a distinct disappointment. In attempting to deal with the art styles of the entire Western Hemisphere, the author fails to give an adequate portrayal of the artistic tradition of any particular area or group. The various tribes of both continents are grouped arbitrarily into seven geographical areas that correspond neither to art styles nor to types of culture, and this meaningless organization results in an inaccurate and highly misleading juxtaposition of objects in the illustrations. Mr. Appleton is equally cavalier about time, and jumbles pre-Columbian and contemporary materials in a most confusing manner.

No systematic attempt has been made to relate the various examples of American Indian art to their proper cultural contexts. Instead the author has included a miscellaneous (and nonrepresentative) assortment of myths and tales on the highly dubious premise that these legendary scraps will disclose what the Indian artists intended their creations to mean. The brief introductory notes abound in loose generalizations and include not a few shocking errors of fact. We are told, for example, that the principal migration route from Asia to the New World was across the Aleutian Islands, and that "Indian languages were not equipped to employ abstract terms . . ." In addition, Mr. Appleton consistently uses obsolete anthropological designations — "Cliff-Dweller," "Mound-Builder," and the like—that ceased to be respectable a half century ago.

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The plates themselves are crowded and unattractive, and the color values are so inaccurate that the illustrations bear little resemblance to the original objects. Since color is as important to design as form, line, or composition, the plates will be of no more use to art students than they are to anthropologists.

Harry Tschopik, Jr.

FIELD BOOK OF SEASHORE LIFE

------- by Roy Waldo Miner

G. P. Putnam's Sons, $6.00
888 pp., 250 black-and-white plates,
24 in full color

NO general manual of the marine invertebrate animals of our Atlantic coast has been published for a great many years. Such a book must deal with most of the marine animals except the true fishes, and the difficulty of the task and the many illustrations required have deterred both authors and publishers from attempting it.

The present book aims to provide such a manual, adapted not only for beginners and amateurs who would be discouraged by too much technical matter but also for more advanced students, teachers, and scientific workers, and for others who want a handy work of reference. These requirements are often directly conflicting, but the book fulfills them with far more success and less compromise than would be thought possible.

This has been accomplished largely by the abundant and excellent illustrations. All of the 1300 species dealt with have at least a small cut to show distinguishing characters and often also a figure on one of the many colored plates. The illustrations are line drawings, not photographic reproductions, which are apt to be obscure on the most important points. Specimens can often be identified simply by looking through the illustrations. In the text the use of technical terms has been kept to a minimum, though of course it cannot always be avoided in a book dealing with animals most of which have no names other than their scientific or so-called "Latin" ones. But the technical terms unavoidably employed are usually understandable or are sufficiently explained by the text and illustrations.

The preliminary paragraphs, or in some cases pages, by which the descriptive matter on the various groups is headed, explaining their chief characters, external and internal, habits, etc., deserve special commendation. They contain a great deal of information and immensely increase the value of the book.

Such a work requires many years of labor to prepare and must necessarily be in many parts a compilation from other works. On many of the groups of animals very little has been published in recent years and many things, among them the frequent changes in scientific names, make it impossible to make every page equally satisfactory and up to date. But such books are indispensable for the progress of science, and their authors deserve the thanks of those who use them rather than criticism for the occasional small errors, omissions, or minor defects that in spite of all care slip into every comprehensive work. As such works go, this is an unusually complete, well-arranged, and reliable book. It will soon earn its price in saving time-consuming research, and it will be one of the most frequently consulted works in the libraries of high schools, colleges, and other educational institutions.

WILLARD G. VAN NAME

FLIES

- - - - - - - - by J. Edson Leonard

A. S. Barnes & Co., $5.00
340 pp., 56 figs., 8 plates

MR. J. EDSON LEONARD has turned out a most exhaustive study on artificial flies for fishing. It is amazing that in such a relatively small volume he is able to treat in detail the complexities of so extensive a subject.

The book takes up Hooks in the first chapter, and systematically in thirteen more, for the beginner or the old hand, it preaches the gospel, "It is better to fish with a fly that will catch a trout than to hunt a trout that will take a fly."

The chapter titles include Tools, Materials, Fly Design, The Wet Fly, The Dry Fly, The Nymph, The Streamer, Surface Lures, Aquatic Insects, and Crustaceans, and there is a dictionary of 2200 fly patterns.

Flies is illustrated with black-and-white "how-to-do-it" drawings, which help make the intricacies of fly tying look simple. There are also full-color plates beautifully executed and faithfully reproduced. It is obvious that Mr. Leonard, who illustrated his own book, not only knows flies thoroughly but also has the precise hand of a talented artist, so necessary in presenting graphically the garnish to his words.

The book itself is so comprehensive and definitive that it may well become a standard reference for the fisherman fly-tier.

The chapter on insects breaks down the orders and families with charts, explaining visually as well as textually the natural fish foods found at certain times on the stream. The names of insects are in the vernacular of the fly fisherman rather than in entomological terminology. Mr. Leonard tells, further, how to imitate these insects, what size they should be, and when to fish them.

Flies is one of those books that prompts us to ask, "Why didn't the author do this long ago?"

RICHARD SALMON

WEEDS, GUARDIANS OF THE SOIL

- - - - - by Joseph A. Cocannouer

Devin-Adair Co., $2.75
179 pp., 20 illusts.

THROUGHOUT his lifetime Mr. Cocannouer has been studying and experimenting with weeds, trying to find out what function they fill in relation to soil fertility. In this book he makes available his findings and gives suggestions for the use of weeds. These are some of his thought-provoking suggestions: allow weeds to grow interspersed with plowed crops as a means of protecting the soil from water and wind erosion; allow deep-rooted weeds to grow in cultivated areas because they bring minerals from the lower strata and make them available for some of the shallow-rooted domestic plants; use weeds as plant material to plow under as a green manure; use weeds as food; or use them to rejuvenate abandoned agricultural lands.

If the use of weeds is one of the means whereby soil fertility can be maintained, then the procedures advocated in this book certainly should be given serious thought.

This is a timely and important addition to conservation literature.

FARIDA A. WILEY

LIFELONG BOYHOOD

- - - - - - - - - - - - by Loye Miller

University of California Press, $2.75
226 pp., 5 plates

THIS is the autobiography of a naturalist, written in a simple, narrative style which holds the interest of the reader.

Loye Miller is an authority on fossil birds, and he has been an outdoors man with an intense interest in natural history from early childhood. He spent his years in the western United States, and he has been associated with men whose names are inseparably linked with the ultimate in field work and with leadership in the classroom. He has been well equipped by inclination and training to make the most of the field opportunities that have come to him.

The subtitle "Recollections of a Naturalist Afield" is a fair appraisal of the contents of the book. Only enough space is devoted to the author's family circumstances and academic career to serve as a background, and many of the pages deal with incidents in the field, often under almost pioneer conditions. The most memorable events of these expeditions are recounted in a fashion that can but recall nostalgic memories to any reader who knew the West at that time.

Miller treats his field work in chronological sequence and then passes to selected writings which highlight the uses to which he has put this field work. In his early trips he collected specimens of the recent birds, mammals, and reptiles, as well as fossil material on occasion. The articles he has chosen show his major interest to be in birds, both the recent living types and the extinct forms of the long ago. It stands to reason that a scientist will understand the birds of the past in direct relation to what he knows of the birds of today.

These papers are not in a language difficult for the layman; they are readily understandable and interesting. Several are on the behavior of living birds, a fruitful field for speculation and one to which much thought is given.

HAROLD E. ANTHONY

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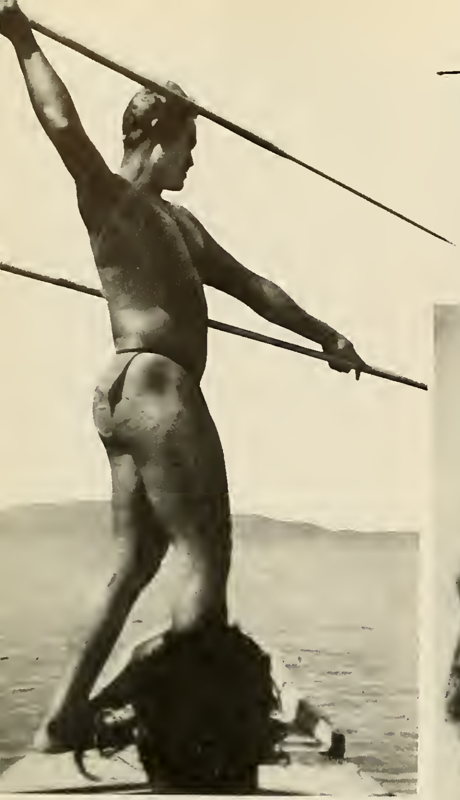


▲ SIAKONG, the best spearfisherman in the Palaus, preparing to spear a fish from the bow of the boat. He holds the second spear for balance as well as for use in case the first spear misses its mark

Field Trip t

Exploring underwater gardens of coral, capturi

AMNH photo

▲ THE AUTHOR in the laboratory of the Department of Animal Behavior at the American Museum of Natural History

◄ DR. CLARK was chiefly interested in poisonous fishes. At left she is seen wearing a face mask and holding the spear she used when fishing among the coral reefs

the South Seas

e and beautiful fishes,
and visiting with natives
who had never before seen
a white woman —
all this and more in
one glorious dream come true

▲ Natives of Mog Mog (Ulithi) and an outrigger canoe. In the distance is the Navy ship that was used on the trip described in the article

By Eugenie Clark

Research Associate, Department of Animal Behavior, American Museum of Natural History

A GREAT deal has been written about the South Sea Islands—romantic novels about poets and painters and shipwrecked sailors. Travelogues, reports of expeditions, and World War II campaigns have made little specks in the Pacific of increasing interest and importance.

My hobby as a child was collecting tropical fishes—from pet shops. As much as some children wanted to become firemen or cowboys, I wanted to become an ichthyologist. I had daydreams about diving among corals and catching some of the beautiful fishes I'd seen pictured in books about South Sea islands. But even after seriously starting the study of fishes in college, I didn't really think that I would get the chance to collect tropical fishes first hand and see the South Pacific for myself.

Then one day at a science convention in New York the Executive Secretary of the Pacific Science Board told about some opportunities for a few persons to study in the South Seas as part of an Office of Naval Research program entitled "Scientific Investigations in Micronesia." I sent in an application, of course, but the forecast didn't look encouraging. Experienced persons who knew much about this area didn't think it likely that the Board would be willing to send a single woman around the Pacific collecting fishes. Life would be too rugged in most places, tropical diseases and the heat might get a girl down, and women fishermen aren't generally encouraged—especially in Micronesia, where some natives not only object to women on fishing trips but consider them bad luck or taboo.

It was then quite a surprise when a phone call from Washington came through saying that the Pacific Science Board was interested in learning more about the fishes of Micronesia and the identification of poisonous kinds, and asking whether I could be ready to leave for the South Pacific in a few weeks. While the almost incredible words continued to come out of the phone giving more details, a number of scattered thoughts rushed through my mind. That very morning I'd accepted an Atomic Energy Commission fellowship that conflicted with this trip; how could I have both? I was in the midst of some experiments for a doctoral thesis; could I finish them in time? And—wouldn't it be wonderful to see the South Pacific and be out of New York during my hay fever season!

It seemed like short notice, and yet once the arrangements were made, I couldn't wait to get started. An extension of the fellowship was granted, the American Museum of Natural History would sponsor the trip, and in general things worked out smoothly. I left the States on June 17 from Alameda by jet takeoff aboard a huge double-decker Martin Mars seaplane of the Military Air Transportation Service—bound for Hawaii and points southwest.

In Honolulu there was a chance to do last minute shopping for a diving mask, jars of all sizes to preserve specimens, etc. At the University of Hawaii, the Bishop Museum, and the Waikiki Aquarium I discussed my proposed studies with Drs. Hiatt, Gosline and Edmundson, and with Mr. Tinker and others familiar with fish collecting in the Pacific. They were encouraging, and the prospects of the trip became more stimulating than ever.

After Hawaii the actual collecting trip began. On Kwajalein, Guam, and Saipan I obtained many varieties of reef fishes by poisoning tide pools. It was after reaching the Palau Islands, however, that I started collecting more selectively by spearfishing with the excellent

◄ IN THE ISLES of the South Pacific, Dr. Clark adopted the throw net in her search. Here she holds the net in the proper position for throwing

▼ WHEN RELEASED, the net is intended to spread open, but this was one of the author's first attempts, and something went wrong

help of skillful native divers. Fewer fishes were obtained, but I was able to secure the exact species I sought—the poisonous plectognath fishes. Moreover, spearfishing is the most pleasant method for the collector who enjoys swimming and observing fish in their natural habitat. In the Palaus, we spearfished around the islands of Koror, Babelthuap, Nemolis, and Kayangel, and on Angaur we even made one collection by dynamiting.

Every few months, from the base at Koror, the Navy sends out a ship on a "field trip" to some of the outlying islands of Micronesia. On these trips the Island Trading Company buys copra and handicraft from natives, who in turn buy cigarettes, cloth, canned goods, etc. from the Island Trading Company. It was my good fortune to be permitted to go along on two such trips. The first was to the little known southern islands in the Palau district: Sonsorol, Merir, Pulo Anna, and Tobi. The second trip was to the northernmost group of islands in the Carolines: Ngulu, Fais, and the Ulithi Atoll. It is about this second trip that I should like to tell you, for these islands struck me as the most fascinating and romantic of all those I had the chance to visit.

Aboard a Navy transport headed by Lt. Parnell, we left Koror at high tide on September 20. I knew two of the other passengers from the southern field trip—Lt. Stille, who was the officer in charge of native affairs, and Father Walter, a Jesuit priest who came along to give spiritual guidance to the natives.

The first night at sea, most of us gathered aft for the ship's popular evening diversion—an outdated, second-grade, black-and-white movie. This was shown on a canvas screen behind which the tropic sun had set in technicolor just a short time before—practically unnoticed. Brilliant sunsets at sea apparently get to be monotonous for sailors, who never tire of seeing movies. In addition to the main feature, there was a "sing" short during which the bouncing white ball was followed by the lusty voices of the Navy fellows, Father Walter, and even a few of the native passengers. During the "girls only"

section, my first yell subsided to a weak solo as I felt the rest of the audience turn to watch with amusement the lone female in their midst.

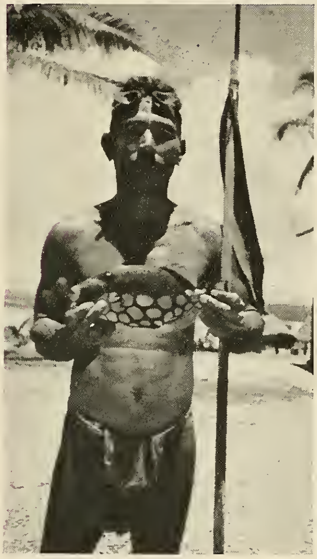
After the movie, Father Walter invited Mr. Stille and me to share some of his bouillon cube soup. This gave me the opportunity to ask about the islands we were going to visit. Mr. Stille had been the officer in charge of native affairs on the previous Ulithi field trip for the Island Trading Company. To Father Walter, these were "his islands," where he had already befriended the natives and was fast learning their language, and where he hoped to preach the gospel for the rest of his life. We talked about the natives, God, and fishes for over an hour before turning in.

Lying in my bunk, I started to preform pictures of Ngulu, the island we were due to reach in the morning, where I would see natives in grass skirts for the first time in my life. I might have stayed awake for hours in fanciful anticipation had not the soft whirr of an electric fan at my head and the gentle tipping of the ship under me put me quickly to sleep.

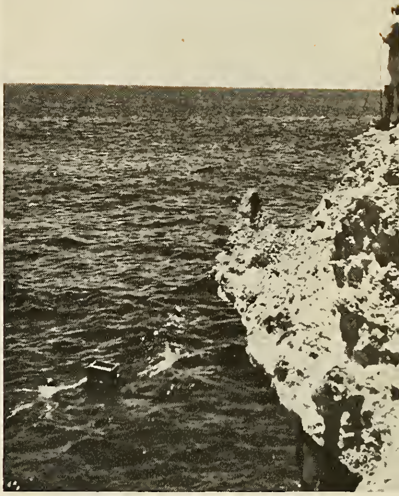
At 6:30 the next morning a knock at the door announced breakfast. We weren't due at Ngulu for a few hours, and so after breakfast I sat up at the bow and watched the flying fishes shoot out from under the ship.

We sighted the little island on the southern tip of the large Ngulu Atoll about 10 A.M. The last census, taken 3 months before, reported 52 natives here. Ngulu was similar to the other islands I'd seen on the southern field trip—at first just a little clump of coconut trees on the horizon seven miles away, and twenty minutes later a village of grass huts peeking out at one point. Coffee-skinned natives were slipping their little outriggers off the white coral beach into the shallow, pale green water over the wide-fringing reef. Out past the reef they paddled into the sudden deep blue waters to meet our ship and welcome us. I could hardly wait to get ashore and went in on the first returning outrigger.

▼ A NATIVE SPEARFISHERMAN of Sonsorol holding a poisonous triggerfish that he speared. He is wearing his double-duty swimming suit and full dress. Because he operates underwater, he uses a slingshot type of spear, equipped with a broad band of rubber which sends the shaft through the water



Unlike most of the other islands I visited, Ngulu did not have copra to sell. Their major products were sculptured wooden figures which the Island Trading Company called "frogmen." Actually they were heavy-browed, triangular-faced pregnant women symbolizing fertility. Several hundred figures ranging from a few inches to nearly two feet were lined up on the beach. Some were carefully carved in bold and interesting lines, whereas others were obviously chipped out hastily to meet the large demand last requested by the I.T.C., which was selling them back at Koror like hot cakes. Mr. Stille wisely bought only the well-carved figures and in his unoffending yet critical manner and gesticulating pidgin



▲ DYNAMITING FISH on Angaur in the Palau Islands. The man on the cliff has just set off the charge. Major Ed Richardson, who took the picture, is shooting at the sharks that were attracted by the dead fish. Dr. Clark and two native fishermen are in the water diving for the dead and stunned fish

▼ THE SMALL SAILBOAT that Dr. Clark and her fishermen used to get to an underwater fairyland of fishes and corals off the island of Kayangel

▲ THE AUTHOR sitting among the high chiefs of Fais, outside the "man's clubhouse." As an outsider, she was not expected to walk stooped over like the women of the island

▼ THE WOMEN of the island of Fais were not allowed to stand upright in the presence of men

English let the natives know he was after quality as well as quantity.

The natives were exceedingly friendly. The women and children came up and patted my arms and held my hands. "You're probably the first white woman they've seen," Stille chuckled. The native women were highly interested in my bathing suit and fingered the gaily-colored material with curiosity and amusement. Stille consulted an interpreter and then reported, "They think your shorts are immodest and your bra superfluous." I couldn't be sure whether he was kidding or not. My outfit was a contrast to theirs. The women and girls wore heavy, bulky grass skirts almost to their ankles, and some had leaves and flowers around their heads or stuck through large holes in the lobes of their pierced ears. Their skirts had the pleasant smell of dried grass—a practical garb for these people, for soap and cloth are rare items. Instead of wearing ragged, patched clothes that accumulate odors with soapless washings, they merely toss away soiled clothes and string together a new skirt.

One young girl had reddish-orange paint on her forehead and cheeks, but her hair was cut short like a boy's. "It helps to keep the bugs out," I was told. This little girl, whom I nicknamed "Red," attached her hand in mine and did not let go until I went in fishing. She took me for a walk through the village, which was beautifully clean and ready for Stille's sanitary inspection. Some of the grass huts had stone or wooden foundations, and almost all the pathways and ground surrounding the huts had been covered with white coral pebbles. Garbage was carefully thrown into holes, where it was burned from time to time and finally covered over. These were teachings that the natives obediently accepted from the Navy, and they understood that the rules were for their own benefit.

At high tide Stille rounded up two Ngulu spearfishermen that spoke Japanese, and so I detached myself from Red and went out on the reef with them.

The tide began going out slowly, but it was still fine for spearfishing. We started from the north side of the island and worked toward the west. The fringing reef around this island was the most beautiful I have ever seen. Colored corals grew abundantly close to the shore, and with them were the rich fauna and flora that are usually found only toward the outer edge of fringing reefs. This was probably because the reef around this island slopes less abruptly into the deep water outside and ravines cut into the reef at frequent intervals. Just a few yards from shore we dropped into one of these ravines. It went down suddenly about five feet, and then we followed the ravine as it deepened to about thirty feet just at the edge of the fringing reef. Here it widened into a spacious submarine coral garden.

The younger of my spearfishermen scraped his arm on some coral while chasing a tiny poisonous puffer. He didn't seem to think the fishes I was after were worth it, and he left, saying that he was too tired to continue. The older fellow, who was more skilled and interested in the odd assortment of fishes I desired, stuck it out for several hours, laughing heartily at my enthusiasm over a little fish he would bring to me—completely worthless to him yet a rare specimen for my collection. At one point we saw a beautiful big orange triggerfish—the largest triggerfish I'd seen and a species I hadn't yet caught. I pointed to it excitedly, and through my face mask I saw my spearfisherman start after this fish that presented more of a challenge to him. The fish swam downward, out of our alcove to where the reef took a deep drop. The fisherman dived after it with his spear poised for a throw. He was down about 20 feet when a large shark swam slowly past above him. He saw the shark but with no alarm came to the surface, took a breath, and made a deeper dive in the same place to recover his spear, which had missed its target. The shark seemed about eight feet long, and I was growing uneasy about its return when I suddenly spotted a pair of barracudas, each about four feet long, approaching from my right side.

It was the first time I'd seen barracudas in the reefs in the Pacific and the first time I'd seen any of that size so close to me in the water. My spearfisherman had followed the orange triggerfish around a wall of coral and was out of sight. I started to recall some armchair discussions about barracudas, in which I had expressed my belief that barracudas do not normally attack forms as large as a man and that when they do, it is because they do not see the form as a whole but are attracted to some small light areas such as the palms of hands or the soles of kicking feet, which stand out as ruptive patterns on an otherwise dark body. Shiny rings and bracelets are thought to be especially attractive. And aren't barracudas caught by fast-trawling small, bright lures? I was deeply tanned, wearing a dark bathing suit, black *tabi* shoes, and no jewelry, and I was barely moving—but none of these thoughts comforted me.

The barracudas had stopped about six yards away and were resting almost motionless near the surface. I backed away easily from the center of the alcove to the rim of a wall of coral that reached within a few feet of the surface. I stood on this, watched the razor-toothed pair of fish through my face mask, and longed to see my spearfisherman. There was a loud splash in the water behind me. Startled and quite terrified, I turned only to see among the bubbles in the disturbed water the nude lower half of a young girl who had just dropped in next to the hull of an outrigger. I put my face mask above the water and saw Red's painted face laughing at me. What a welcome sight! She was hanging to the side of an outrigger in which she had left her bulky grass skirt. I was overjoyed to see her, and she felt it and swam happily toward me. I pointed to the barracudas before it occurred to me that she couldn't see them very well without a face mask or goggles. I motioned to her to climb into the boat, and after a last look at the large silver forms still in the alcove, I quickly followed. Some distance away I saw my spearfisherman come up for a breath. We called him over, but when I looked again the barracudas were gone, and his only reaction to my serious description of them was a giggle and the supposed-to-be comforting Japanese phrase, "*Abunakunai* (Not Dangerous)."

We paddled the outrigger a good distance from the alcove to continue our fishing. When we went back to the village, Stille was anxious to return to the ship, and we left hurriedly. I gave the usual salary to my spearfisherman plus a gift of cigarettes, and for Red I left some candy and chewing gum. Back on ship and ready to pull away from Ngulu, I spied Red and my spearfisherman among the group of outriggers bobbing about the stern of the ship, waving a last good-by to me. It didn't seem that our acquaintance had been for less than a day and that we'd exchanged but a few words of broken Japanese.

We arrived at Fais near noon of the following day. The native men came out to meet us in large outriggers of bright orange and black. When we reached shore, all the high chiefs of the island were sitting cross-legged in front of a large grass hut—"the men's house." Stille presented me to them, and I shook hands with each of them during an exchange of curious glances. Their faces were serious and dignified, and they presented a weirdly beautiful picture. Their bodies were heavily tattooed from the neck down with vertical stripes and designs of various types, some of which I made out to be fishes. One old chief had apparently tinted his gray hair and beard with the same shade of dye that "Red" on Ngulu had used on her face.

During most of the day the chiefs hardly budged from their original position. They chatted with us (two could speak some English), smoked the cigars Stille brought them, and were overseers while the other men rushed about loading copra, bringing us coconuts to drink, and waiting on the chiefs. Aside from the more elaborate tattooing and headdress, most of the chiefs could be readily distinguished from the common natives by their bulging bellies, fat bodies, and smoothly rounded and relaxed limbs, as com-

▲ Father Walter (S. J.), formerly of Fordham University and now settled permanently in the Caroline Islands, celebrates mass for the natives of Ulithi, many of whom are Christians

pared to the slim, taut, muscular bodies of the "workers."

I became curious to see the women of this island. Stille and Father Walter had told me that instead of grass skirts, the mature females here wore laboriously hand-woven cloth skirts called lava laps. But there were no women around, and we had been on the island for over an hour. Some time later I noticed that one by one they were slipping out from behind coconut trees, walking in a peculiar, crouched-over position with their backs almost parallel to the ground. Stille then told me they had to walk like that in the presence of men—a law of feminine obsequiousness on that island that I was brazenly breaking! Ignorance of the law is no excuse, but the chiefs were lenient with me and never said a word.

I joined a few of the women sitting under some trees, and soon a large crowd of them gathered around. None of them spoke Japanese. I started a sign language conversation that was accompanied by sympathetic giggles and laughter, and the women reciprocated until we must have looked as though we were playing a game of charades.

Most of the older women's forearms and legs were tattooed, and they wore bracelets, beaded necklaces, and belts. The belts held up their colorful lava-lap skirts, which were folded in such a manner that the loose edges met in front, forming an attractive hanging fringe. Each woman carried a good-sized "pocketbook" made of a woven coconut frond and containing paraphernalia similar, I guess, to what most of us are prone to tag about with us (paint for the face, cigarettes, etc.).

The "number one" chief offered his two finest fishermen to help me with my collecting. We spent a profitable and enjoyable time spearfishing at the end of the fringing reef. When we returned, all the copra had been brought to the ship. Mass and confession were over, and native affairs settled. The chiefs promised to stage a dance for us in the evening. We stayed for a supper of breadfruit, fish, and bananas with the natives, and then came the floor show. It was pitch dark by then, and a large bonfire was built on the beach. The evening was damp and cool. I'd given my dress to a chief's wife, who with the other women had greatly admired the bright-colored cotton print, and I was left wearing only my damp bathing suit. I welcomed the opportunity to push my mat into a warm, dry spot near the fire.

The men, I was told, would not dance because they were worn out from carrying the large sacks of copra, but the women were ready and willing to perform. They lined up in a row of fifteen. The center women were the oldest and obviously the leaders who knew the dances best. The breasts became firmer and higher toward the ends of the line, where the young girls made up in attractiveness what they lacked in dance training.

The dance started with the women stamping their feet in rhythm to a low chant. As the dance progressed, they hardly moved from their spot but turned in place, first to one side then the other, and sometimes completely around—the sinuous movements of their bodies becoming increasingly emphasized. Their arms hung loosely much of the time, but sometimes

▼ Ueg, King of Ulithi, in his royal wagon. Since stricken with polio, the wise and kindly monarch has had to be carried or wheeled around his island

◂ **Dr. Clark,** with a diving mask on forehead and accompanied by two native spearfishermen, beside the rubber boat that proved useful when collecting specimens in Ulithi

they swayed in movements complimentary to those of the body or they waved about in rag-doll fashion slapping the thighs and buttocks from time to time. The girls at the ends of the line frequently missed their cues to turn at the right time and obviously bluffed through the words to parts of the chant. But their improvisations were of ceaseless charm to Stille. Father Walter, however, accustomed to these dances on his home island of Yap, played with the children and was the most casual spectator at the weird dance held in the light of a bonfire. The excitement mounted as the chanting grew louder and higher in pitch, ending finally in a sudden and abrupt mass yell.

We applauded enthusiastically. Some of the entertainers acted as if we weren't there; a few glanced our way and then giggled self-consciously. Then all eyes went to the center woman, who cued off, and a second dance began. The women had prepared a limited number of encores, at the end of which they all walked away, and the bonfires, perfectly timed, petered out to just a warm glow.

▾ **Lt. Harry Stille,** discussing business with the native chiefs of Fais

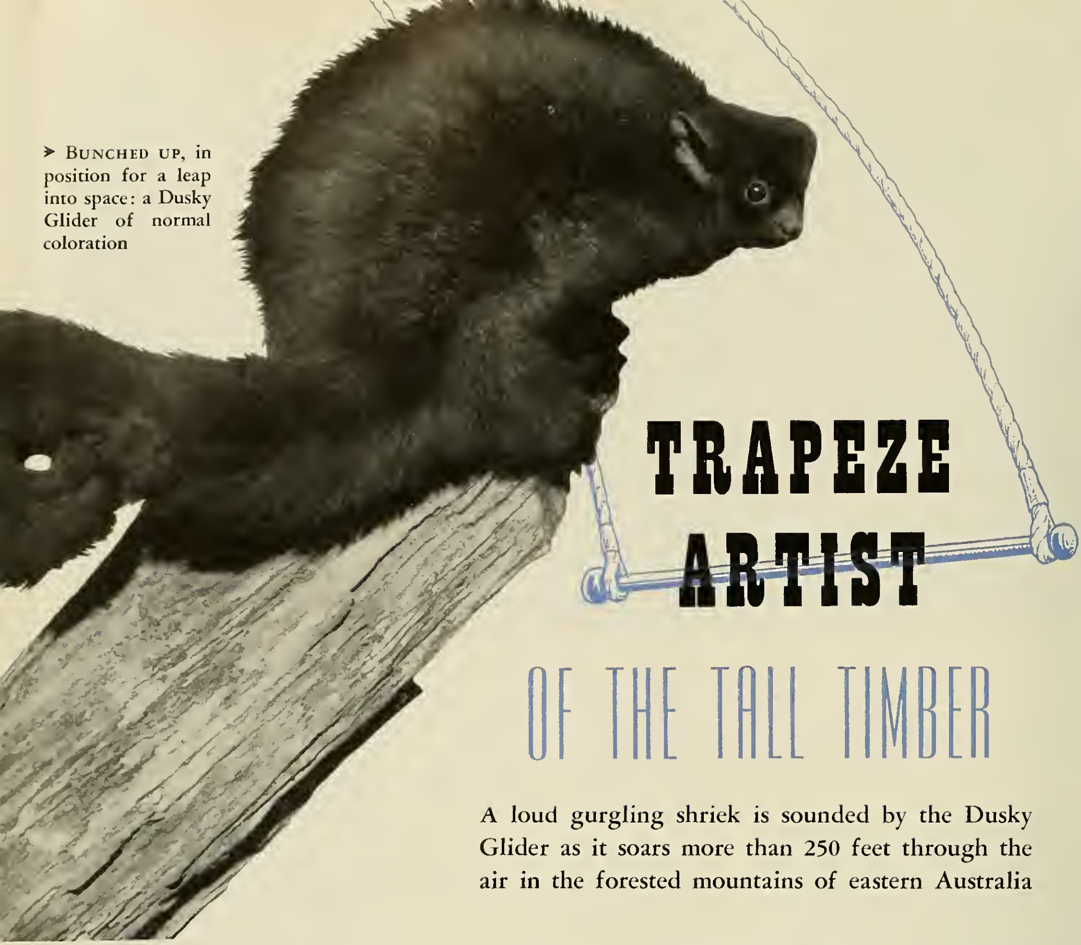
In the darkness we bade farewell to the people, thanked the chiefs, and returned to our ship. We didn't attend the "Western" that was being shown aft but turned in early after some of Father Walter's bouillon.

The following day we arrived at the sausage-shaped atoll called Ulithi. Although Ulithi is composed of some 49 islands, only 7 are inhabited. The villages on each of these are headed by one or more chiefs, but the supreme ruler of the Ulithians—the chief of chiefs—was King Ueg.

Our first stop was on the island of Mog Mog, where the King of Ulithi lived. I never dreamed that at my first meeting with a king I would be in my bare feet, bathing suit, and pigtails, with the king in a G-string!

Word of his coming reached us shortly after our arrival on the island. I had heard that King Ueg had been a polio victim some years back and was now unable to walk. I expected him to be brought out on a royal platform carried on the shoulders of his subjects, but I was mistaken. Instead, a lone native approached us pulling a little rubber-tired wagon in which sat the king. The royal wagon was a rather funny sight, and the withered lower limbs of its occupant were pathetic; but Ueg's face itself was truly majestic. He had a fine straight nose with firm nostrils, sharp blue eyes, highly arched eyebrows, and thick black, curly hair. The contours of his face were handsome. He looked dignified, wise, and kind, and although most of the time his expression was solemn, when he smiled it was with sincer-

Continued on page 46



➤ Bunched up, in position for a leap into space: a Dusky Glider of normal coloration

TRAPEZE ARTIST

OF THE TALL TIMBER

A loud gurgling shriek is sounded by the Dusky Glider as it soars more than 250 feet through the air in the forested mountains of eastern Australia

By David Fleay

All photographs by the author

One of the really remarkable mammals in Australia is the largest species of parachuting or gliding possum—the Dusky Possum Glider or Greater Glider *(Schoinobates volans)*. In over-all length, this skinny-framed "flying rope walker" may total forty inches, but over half of this is taken up by the pendulous, bushy tail. And though appearing to be a big creature, its weight averages a mere three pounds.

Normally dusky-black in color, with long, soft, and silky fur, the somber-hued creature is highly specialized for life among the great eucalypts of the eastern and south-eastern highlands of Australia. The animal ascends the trunks of the gums with an extraordinary galloping motion, and when it lands at the end of an 80- to 90-yard swoop, its extremely sharp claws readily grasp the hard, smooth trunk of the tree.

Fully as distinctive as the Dusky Glider's unusual appearance is its musky, eucalyptus oil odor; and though the animal is thoroughly dainty and clean in a "gummy" fashion, it is not long before the lofty hollows that form its daylight retreats acquire this pungent, distinctive, though by no means disagreeable odor of musk and bruised gum leaves.

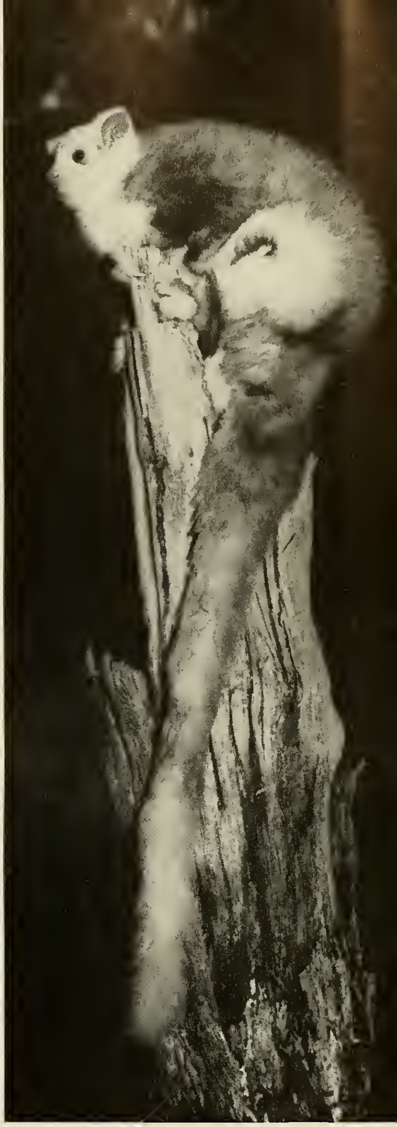
Although the Dusky Glider is the most numerous of the larger aboreal furred creatures in the forested mountain country of eastern Australia, it is one of the most delicate and difficult marsupials to maintain in captivity. It is the only gliding possum that is a leaf eater, and unless it is able to secure a select variety of eucalypt foliage, it simply will not live. In this respect it resembles the koala. Its diet is close to that of the common Ring-tailed Possum *(Pseudocheirus)*, which most nearly represents the ancestral stock of the Dusky Glider. In both, the skull characters, teeth, and facial appearance are similar. In fact, we might call the Dusky Glider the "flying Ringtail" of the really big timber. The true Ringtail lives in the lower levels and cannot find a toe hold on the almost glass-smooth trunks of the great trees.

In typical specimens, there is a white area underneath, contrasting with the black of the back and tail. The large ears are thickly covered with fur on the outside but not on the inside. These, coupled with the bare pink nose and solemn eyes, invest the animal with that somber and wistful expression so often observed when it gazes forth from a lofty hollow after someone has tapped the base of the home tree with an ax. Though normally dusky-black, the general color is variable, ranging from dark animals, through others with smoke-gray flanks, to almost white and really white animals.

One of these large gliders shooting down through space on its aerial jaunts looks for all the world like a swiftly diving kite. Its volplaning membrane, unlike that in the genus *Petaurus* (Sugar and Yellow-bellied species), does not extend from the outer digit of the "hand" to the ankle of the hind foot. It stretches from the elbow of each forelimb to the ankle. Therefore, while in midair with the membrane outstretched, the animal tends to assume more of a triangular shape, with the apex forward.

The home tree of the Dusky Glider is usually a large gnarled and knotted old giant, as often dead as not, and the nesting hole is high up in the trunk. From these daylight havens the inhabitants may be seen coming forth at deep dusk, stopping to comb their fur and scan the world of big trees before going about their nightly business. It appears that, though nests of stripped bark or leaves are built in these retreats, the black gliders are casual about embellishing their comforts. The species has apparently lost a good deal of the collecting and architectural ability of its Ringtail forebears.

The home trees are usually betrayed by varying degrees of shred-



▲ A TAIL that is longer than the body does not prevent this creature from being one of the greatest gliders among wingless animals. The crinkled edge of its flying membrane is visible. In flight, this is stretched between the elbow and the ankle on each side. This is a partly white specimen

◀ A BEAUTIFUL smoky-bodied, white-headed female Glider recently found near the Murrundindi River in central Victoria

◄ NOTE the sharp, curved claws that enable the Dusky Glider to cling to the hard, smooth bark of the big trees at the end of an 80-yard glide

➤ AN "OLD MAN," distinguished by his lack of fur on rump and tail base, climbing the broad face of a great eucalypt

ding or scratching of the bark (depending on whether it is the stringy or smooth type), where the well-developed claws have scored the surface in "landing." To the experienced eye, the characteristic cross scratches on hard-barked eucalypts tell of frequent skidding stops made by volplaning possums.

One is usually able to determine whether the inhabitants are at home by striking resounding blows on the trunk with an ax. Soon a shaggy head may gaze forth, followed by the total emergence of one or two animals. Finding the vibration unpleasant, they proceed to climb upward with their characteristic galloping motion until finally they perch on the topmost point of the tree, their long tails waving loosely in the wind. Further blows at this juncture usually cause the animals to bunch up and leap forth, and then to glide away down some well-known aerial track to the safety of a trunk 40, 60, or even 80 yards away.

The mention of aerial tracks is not an exaggeration. Time and again I have noticed that, in springing forth with outstretched limbs from the upper boughs of the home trees, and setting out for nocturnal feeding grounds, Dusky Gliders travel in stages, using the same trees for landing and lobbing each time at much the same spot on the lower trunk.

Usually when tapped gently forth from an upper hollow, gliders wait until quiet reigns once more and then return slowly to the hole, rolling the long tail into a furry ring at the moment of re-entry. This action leads me to believe that when transporting nesting material, this animal may quite possibly carry it in a twist of the tail, just as I have seen the Ring-tailed Possum and the Sugar Glider do.

The momentum that carries the glider such great distances is gained from the initial, almost vertical dive. Naturally, the higher the starting point, the farther the creature is able to glide. After the dive, it flattens out and finally sweeps gently upward for a landing, thus reducing the shock of its impact with the tree. Having lobbed, the glider climbs with its curious gallop into higher regions.

The Greater Glider, so much at home in the treetops and in the air, is a ludicrous sight on open ground. Its progress is extremely awkward and slow and may best be described as an undulating gallop—the main object being to find something to climb and find it quickly. Occasionally, however, either by accident or design, the animals do appear to journey across open spaces, risking destruction by the fox.

By observing captive specimens, I found that these strict leaf eaters were extremely fond of the common peppermint (*Eucalyptus australiana*) and Long-leaved Box (*E. elaeophora*). To a lesser extent they took Swamp Gum (*E. ovata*), Manna Gum (*E. viminalis*), Apple Box (*E. stuartiana*), Mountain Grey Gum (*E. goniocalyx*), River Red Gum (*E. camaldulensis*), and several species of stringy bark, but they showed a definite dislike for many other species. The almost cosmopolitan taste of other herbivorous possums, such as the Silver Gray and Ringtail, for succulent young leaves of almost any description is certainly not shared by *Schoinobates.*

Animals kept in confinement may be persuaded to acquire an additional taste for bread and milk spread with sweet jam or honey, but this is only possible as an adjunct to the diet of eucalypt leaves. Melon and lemon jam is a favorite with the Greater Glider, just as it is with numerous other marsupials.

It is interesting to note that, apart from the consideration of diet, the animals will not thrive in captivity unless supplied with a log or box fitted after the style of a "home tree" and situated in a lofty position in a roomy enclosure. Long sapling poles and stringy bark boughs are also provided, for seldom, unless sick, will the Greater Glider descend to the floor of its cage.

The breeding habits of the Dusky Glider are similar to those of other members of the possum family, except that the development of the offspring is rather slow. Like other possums, it is a pouched animal, or marsupial. Only two mammae are found in the pouch, and as in the genus *Trichosurus* (the Silver-gray and Short-eared Possums), only one embryo is reared at a time. In Victoria, this minute naked creature seems to appear usually in July or August; and it is difficult to realize that such a mite, no longer than the head of a thumb tack, may indulge some day in graceful aerial "flights."

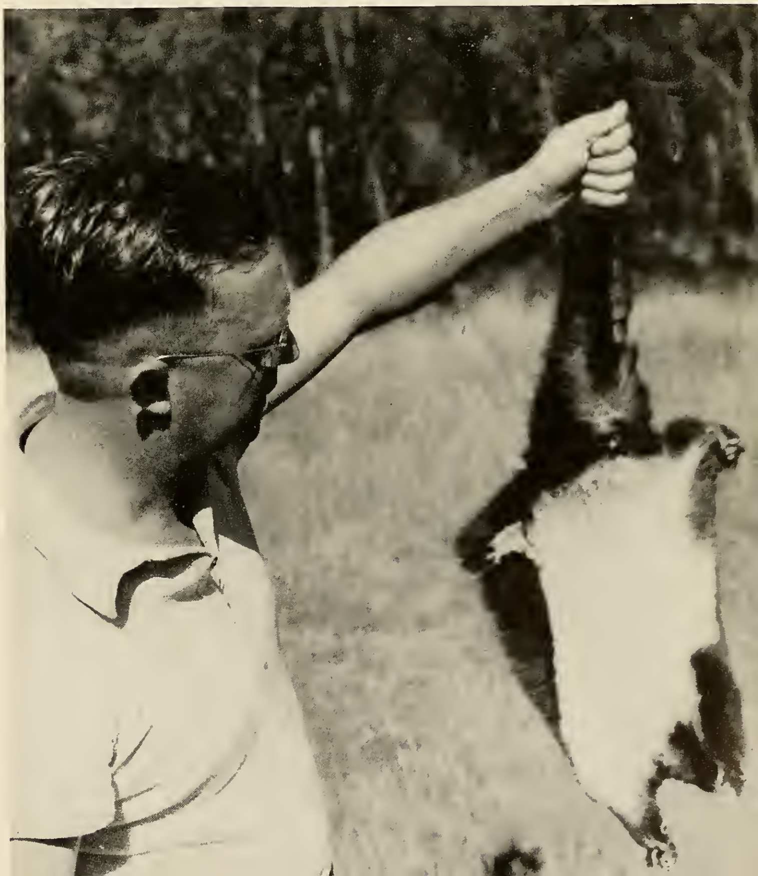
Like any other young marsupial, it makes its early journey into the pouch entirely under its own steam. Gradually as the youngster increases in bulk, it becomes evident that the limbs and tail are extraordinarily long, and the loose volplaning membrane from fore to hind legs is plainly visible. The color of the furless embryo is pink, with very dark ears. Naturally, all inspections of the pouch are conducted under difficulties, for the mother resents the handling, and there is also considerable danger of harming the infant.

The joey appears to become free of its attachment to the mother when some six weeks of age. It is then able to attach itself to the source of nourishment or relinquish it at will. Later the eyes open, and a covering of short fur indicates more plainly than in the adult the contrast between the black-and-white upper and lower surfaces.

Between the time of growing fur and the forsaking of the mother's "pocket nursery," the young Greater Glider is one of the most curious and pathetic babes that one can imagine. Lanky legs, very long tail, and thin, weedy body combine to produce a most extraordinary little creature. There is a period during which the little joey spends its daylight hours outside the maternal shelter and is carried about in it by night. Before the animal is four months old it has outgrown the pouch (though it still gets its nourishment there), and then the little glider may cling to its mother's back during her nocturnal wanderings. For her the gliding leaps are no longer possible unless the youngster remains in the home tree or sleeping hollow.

Throughout 1925-27, I had in captivity a pair of Dusky Gliders from the Daylesford district, and during this time they produced several young. Generally the single joey arrived in early August, but strange to say, none of these offspring grew to maturity; they died shortly after leaving the pouch. In later, more successful experiments I found that particular care was necessary as the weaning phase was reached. The baby animal required a most careful selection of gum tips, not only in regard to species but also to the maturity and delicacy of the branch tips themselves.

You may wander under the trees without ever discovering the Dusky Gliders feeding overhead, unless you listen intently. Perhaps the



➤ **THE GLIDING MEMBRANE** broadens as it extends from elbows to ankles. When soaring swiftly from one tree to another, the animal looks like a triangular kite with a long furry tail faint sound of a leaf being pulled from a stalk, or a sudden rustle as the animal shifts its weight from one slender limb to another, betrays its position to a searching torch beam held so that the observer's eyes look straight along the path of light. Then the blazing orbs of the animal, certainly the most brilliant light reflectors I know of among marsupials, regard the intruder with some curiosity. But this curiosity is scarcely sufficient to interrupt the meal. Soon the glider puts forth a long forearm to pull more leaves within reach, or moves to a more favorable position, its rangy shape and very long tail dimly silhouetted against the starry heavens.

The startling and extraordinary call of the Greater Glider, heard so frequently in the tall bush by night, particularly in the late autumn, is one of the animal's most distinctive characteristics. It is a loud gurgling shriek running down the scale in a bubbling or even chuckling fashion, accelerating though diminishing in volume. It is uttered mainly while the marsupials are moving actively and indulging in gliding leaps. One hears the initial loud notes, then a rapid gurgle diminishing perhaps with the increase in distance, for by then the swiftly traveling vocalist is shooting at speed to a point perhaps 80 yards farther on through the trees. The calling ceases upon its arrival, when the characteristic "clop" of landing is heard.

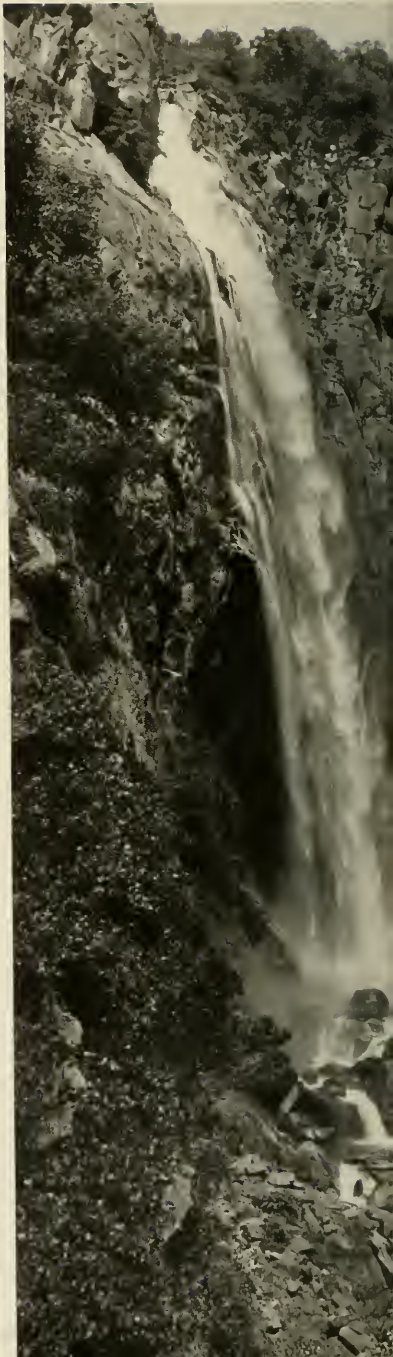
From close watching and listening, I think it is certain that these cries are a means of keeping in touch, because members of a pair move through the bush on a "follow the leader" principle. The animals are particularly attached to each other, and the gurgling shrieks, so typical of the deep forest, are really signal cries—an accomplishment far beyond the powers of nongliding possums and one that was probably developed in conjunction with their powers of flight.

It is fortunate that from a commercial point of view the Dusky's skin is extremely thin and papery, and the soft silky fur lacks permanent rigidity. This, combined with the fact that the animals have an inseparable attachment for dense forest lands and do no economic damage whatever, makes it unlikely that man will molest them. Bush fires, however, are the scourge and bane of these animals. They become utterly helpless, and I have watched them twirling in agonized bewilderment down into the onrush of consuming flames. In the holocaust of early 1939, tens of thousands of these volplaning creatures perished in the Victorian ranges, and many that survived in odd sheltered gullies died subsequently of starvation, because the leaves of their food trees, where not consumed by fire, were blasted and withered. For weeks after the flames had died on Mount Riddell and Mount Toolebewong, we found tortured Greater Gliders crawling weakly over the charred ground, their black color camouflaging them amid that desolate world of stark, dreary ashes.

The extraordinary rehabilitation of the species after the dreadful fire is remarkable, considering that a pair of Greater Gliders rears but a single youngster a year. In the middle 1940's, during many nocturnal quests on the slopes of Mount Riddell, Healesville, I was amazed to find the big gliders quite numerous again. Certainly the deep valley of Badger Creek was not entirely devastated by fire, but judging from the surviving stock in this valley, and perhaps in others far away, it is evident that an increase must have occurred.

The Dusky's one consistent enemy is the Powerful Owl, a great bird of the night that is really dependent on the Greater Glider and Ring-tailed Possum for its meals. This largest yet shyest of Australian owls dwells in the same country as the Dusky. While I was making a special study of this little-known bird of prey, I was amazed to find that it carried off at least one Greater Glider or Ringtail practically every night. In denser ranges, the victims were usually Greater Gliders. It is indeed fortunate that the Powerful Owl is a rare bird and therefore makes little impression on the population of this plentiful animal.

Feather

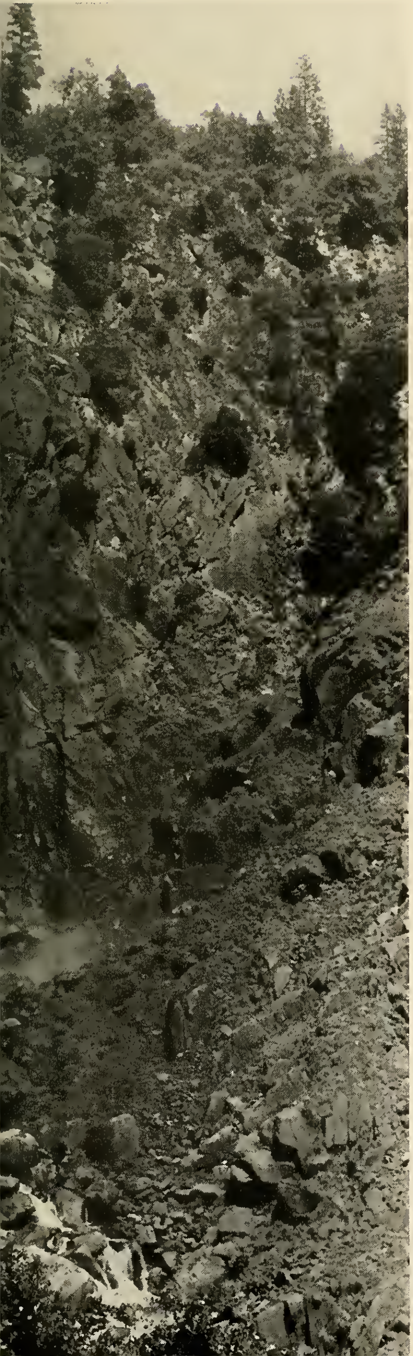


Falls

The rediscovery of this spectacular cascade swings open the gates to one of northern California's least exploited wonderlands

By Philip Ferry

All photographs by Alfred Schmidt



▲ **The party** consults a Forest Service topographic map before getting under way for Feather Falls

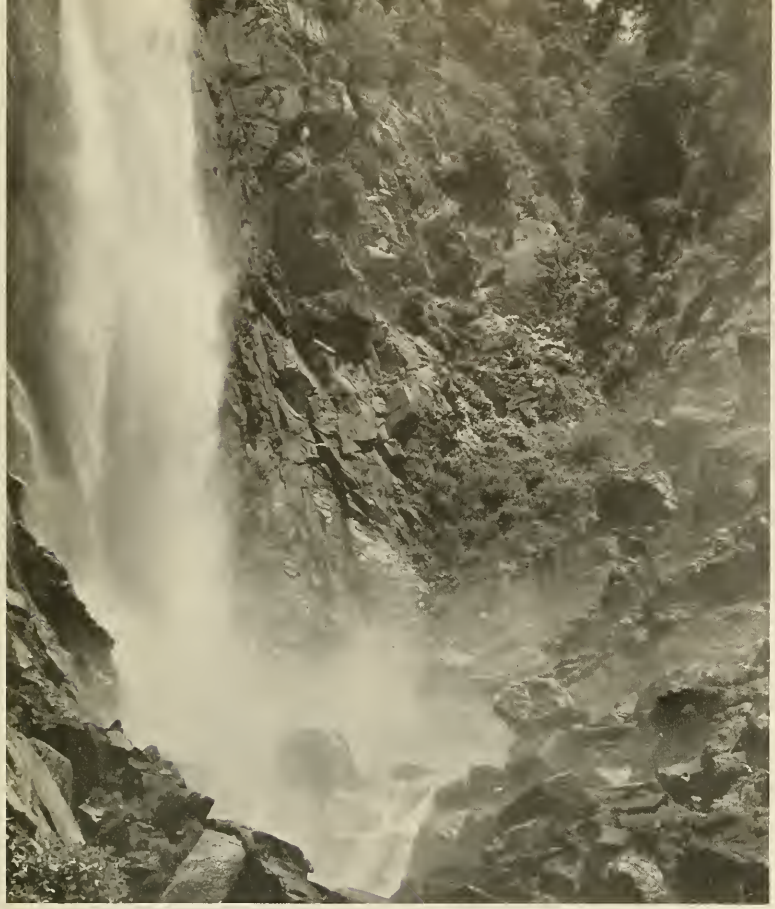
THE Feather River Canyon country is one of northern California's more popular trout fishing grounds and one of its famed vacation resort areas. Notwithstanding these natural attractions, there are sections that have been little visited by the general public. The region is mountainous, with swift-flowing rivers, precipitous slopes, and narrow gorges that can be infernally hot. Hence it is not surprising that much of its rugged back country has been neglected by visitors.

This region jumped into sudden prominence early in 1950, when a starry-eyed flycaster came out of the wilderness to report excitedly that he had seen a magnificent waterfall of unbelievable proportions. The Forest Service, which had known about the fall for years, declared it to be 654 feet in height; and a California State Park Commission survey described the cascade as "one of the most beautiful in the state."

◄ **The 654-foot cascade** flows the year round and has even more volume at some seasons than in June, when this photograph was taken

There are not more than a few dozen waterfalls in the world with a height of 600 feet, and our group immediately began making plans to investigate this latter-day natural wonder. Just one week before our visit, a leading San Francisco newspaper carried a feature story on the area. Black-and-white photographs accompanying the story vouched for the size and beauty of the waterfall. Late last June our group of seven spent two days at the site.

The fall goes into the middle fork of Feather River, in the Plumas National Forest, Butte County, California. From Oroville, a winding road leads up into the foothills of the Sierra to the hamlet of Feather Falls, a one-industry logging town. Five miles beyond the town we took



▲ As yet visited by relatively few persons, this fall is one of the outstanding features of its kind in America. Its height is about four times as great as Niagara Falls

a dirt road that headed west. This portion of the drive is made through a dense forest of sugar pine, yellow pine, incense cedar, Douglas fir, black oak, azalea, and dogwood. The road is poorly marked, and it is necessary to obtain full driving directions in the hamlet of Feather Falls.

Five miles on this primitive road brought us to a spot called Red Point, where we parked the car at the head of the steep foot trail leading down to Fall River. Shouldering our backpacks, we set out down the trail for Feather Falls. It is not necessary to backpack into the canyon. The trip to the top of the fall and back can be made in a single day—a long hard day—on foot. But since we planned to stay two days, we carried the necessary equipment.

The first leg of the hike, down an exceedingly steep, neglected hillside trail, proves a trap to the unwary, for the 1200-foot ascent later in the day finds him reaching the rim completely exhausted. However, there are compensatory rewards at the trail's end. A half hour on the trail brought us to the cabin of "Indian Al" Williams, an elderly man who looks after the holdings of the Watson family. The Watsons took up the land a generation ago, at a time when homesteading was permitted in national forests, and the family still holds title to the property. We were fortunate to meet Gerald Watson, one of the younger members of this extensive clan. He volunteered to join us on the following day and guide us to the base of the fall, over a trail we would never have found without his assistance.

We camped beside Fall River near the point where the cataract starts its plunge into the lower canyon. We spread our sleeping bags in a veritable forest of fragrant azalea. Roundabout was a generous display of late springtime wild flowers, including brodiaea, clarkia, collinsia, and penstemon — both the red and blue varieties. In the swift-flowing stream grew tall clumps of giant-leaved, umbrella-shaped Indian rhubarb (*Peltiphyllum peltatum*). Water ouzels dipped up and down on the flat boulders and ran along the smooth streamside granite, surveying the water for food.

We walked over massive granite boulders to the headwall, where the stream dropped away under our feet. There we got our first look at the fall, a perpendicular perspective straight down the length of the fall from top to bottom. The first astonished impression was that here was a first-class waterfall. This was not a local phenomenon that might pale beside other and more famous cascades. Feather Falls has a magnitude that is truly impressive. Aside from Yosemite Falls itself, it compares favorably with any cascade in Yosemite Valley—an area noted for its waterfalls.

Fall River, in forming the fall, charges down a narrow rock chute, spurts through a jumble of immense granite boulders, and cascades perhaps 100 feet to a broad apron. Here it drops into several potholes, describing some tremendous water wheels in its flight, and finally it leaps several hundred feet down the perpendicular wall. It is a noisy, boisterous, plunging body of flying water, which crashes against the rocky bottom with an explosive impact.

Young Watson, who was born and raised in the immediate vicinity, says the stream flows the year round. The area gets only about two feet of snow in winter, and the stream does not freeze. While we were highly impressed with the volume of water flowing in late June, Watson assured us that the volume is much greater in the early spring months. The gorge into which the fall plunges is a U-shaped box canyon, and the fall is located at the very end of the canyon. A footpath constructed by the Forest Service some years ago circles the head of the canyon on three sides, affording tantalizing glimpses of the fall. Perhaps the Forest Service may see fit one day to remove much of the vegetation that now screens the fall from the trail. At the present time, a full-length view can be obtained only by scrambling part way down the wall to a rocky perch opposite the fall.

The canyon bottom is choked with mammoth boulders, through which the stream charges with a mighty clatter. The canyon is narrow at this point, and the flying spray drenches the opposing wall, clothing it in lush greenery and filling the gorge with rainbows that arch the canyon from wall to wall. The runoff from the fall forms a full-sized stream, which flows down the canyon some three miles to be completely swallowed up by the middle fork of Feather River.

It is not necessary to descend to the base of the fall, and the inexperienced are cautioned against undertaking this second drop unless they are prepared to do some rugged climbing and to withstand some broiling hours in the sun. By remaining at the middle level and reaching the rocky perch on the wall opposite the waterfall, one can take in all the beauty without making the exhausting drop to the river's lower brink.

The actual discovery of Feather Falls is attributed to two members of a United States Geological Survey, who were the first white men to penetrate the Grand Gorge of the middle fork of the Feather River, sometime around 1888. The announcement of the discovery caused a tremendous stir, and in the enthusiasm of the moment the fall was billed as "another Yosemite." Sometime in 1913, the fall was rediscovered and came in for more publicity. Again the furor died down, and the fall lapsed into obscurity. It was known only to local residents and a few unimpressed sportsmen—in spite of the fact that Forest Service topographical maps of the area invariably included the fall, and at least one automobile club noted its presence on their road maps. This neglect was due, of course, to the difficult nature of the terrain and to the fact that all reports placed the fall in an "impassable" canyon. While much of the surrounding country is extremely rugged (the canyon of the middle fork reaches a depth of 3000 feet), it is unlikely that any of it is impassable. Feather Falls itself is readily accessible, as our visit demonstrated. Any normal person can make the descent from the road to the headwall of the fall in two hours; climbing back is, of course, a more difficult feat.

While the descent into Fall River canyon is a bit strenuous, it pales beside that of a notorious chasm located just over the ridge from the fall. Bald Rock Canyon is a local legend. Tradition pictures it as a veritable devil among canyons. Golden Land, who is an official of the lumber company, postmaster of the lumber town called Feather Falls, and an authority on local history, reports that only three parties are known to have penetrated Bald Rock Canyon for much of its length. Land himself led a party into the region some years ago, and while the men spent several days in the canyon system, they did not succeed in completely penetrating Bald Rock Canyon. In one short side canyon leading into the main gorge, the party counted 52 waterfalls upward of 10 feet in height. The gorge narrows in places so that it is necessary to climb out on occasion and rim around. The Forest Service contends that for all practical purposes portions of Bald Rock Canyon are impenetrable.

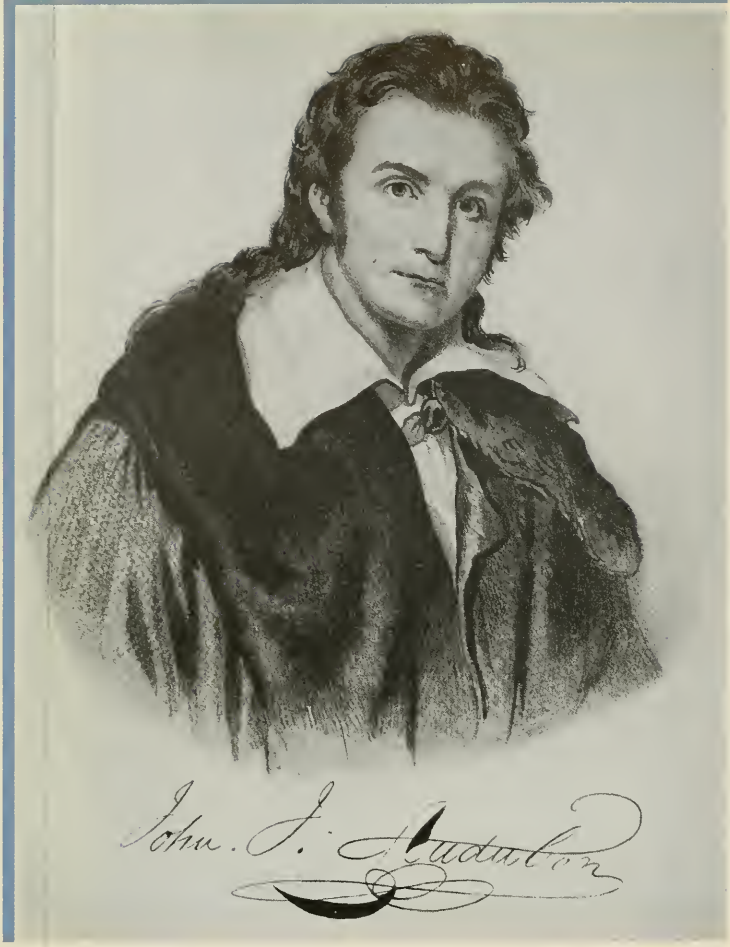
The Fall River section of the Plumas National Forest is one of California's few outstanding scenic areas still left unexploited. And Feather Falls, it is necessary to repeat, is a superlative waterfall. If the area is to be preserved while it still retains some of its original and as yet unspoiled beauty, there may be no time to lose in launching plans to have it made into a state or federal park. Experience has shown that in the realm of natural resources and preserves, what is once lost is irrecoverable. Nature has given us here a superb gift; it is for us to do our utmost to preserve it intact, both for ourselves and for future generations.

Surprisingly enough, the California State Park Commission has known about the fall for 25 years and once recommended that the area be incorporated in the State Park system, and a portion of the proposed 3000-mile master loop Riding and Hiking Trail extending from the Mexican to the Oregon border, will go through the Feather Falls area. Apparently the importance of the region has never been sufficiently emphasized, and as a result an unsuspecting public has remained apathetic. This attitude may prove fatal. Hanging over the area like a sword of Damocles is the ever-present threat of logging operations. In fact, timbering is already going on in the National Forest, within a few miles of the fall. Since logging is the sole support of the near-by hamlet of Feather Falls, this is not surprising. The operations have already extended into the Fall River section and adjacent private lands. This would drastically alter the status of the watershed and adversely affect the volume of the river and, as a natural corollary, the flow of the fall.

Unhappily, those holding homestead patents within the National Forest are most anxious to have lumbering extended into their holdings. This is only natural. Standing timber is a frozen liability, while lumber is a negotiable asset. Since at least one of these private holdings virtually abuts on Feather Falls (in fact, one family actually lays claim to the fall!), it is obvious that the dark cloud hanging over the area is no mirage.

This is a threat that is not to be taken lightly, for the rewards at stake are too valuable to be relinquished without a struggle.

This month, on the 100th Annive



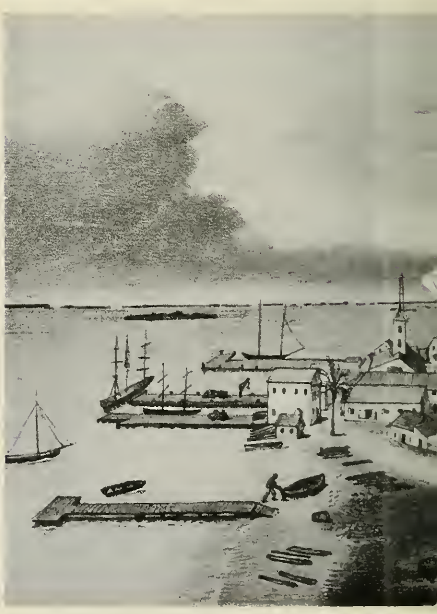
◄ **John J. Audubon** at the time he made the trip to Key West in the early 1800's

With *Audubon* in the FLORIDA KEYS

By Lucy Salamanca

It is remarkable that only sparse recognition has been given to the extraordinary effect his sojourn in the Florida Keys had upon the eminent naturalist John James Audubon. His visit to the region not only revived his discouraged spirit but left its beneficent mark upon the work that was his legacy to mankind. The Keys gave back to Audubon that young and fresh delight he had once taken in the whole natural world and which had well-nigh been lost to him amid the uncertainties, deferments, and unrewarded exertions that marked his struggle toward the dream of his maturity—to catalogue and paint the birds of America in their native habitats.

Moreover, his visit to these islands that fringe the southeastern coast line of the United States, stands today as perhaps the most exciting,



ry of the great naturalist's death, we can thrill to the little-known interlude

that marked a dramatic turning point in the career of John J. Audubon

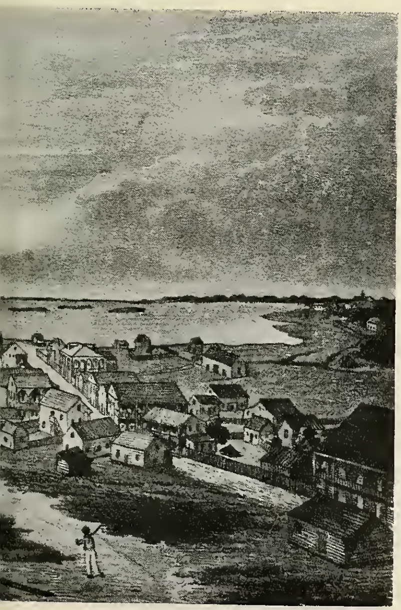
colorful, and fruitful interlude in the life of the gifted and devoted naturalist. Certainly it had in it all those elements that appeal to the adventuresome spirit of man. Audubon made the most of every moment, trailing after unlicensed wreckers through the waters of Gulf and Ocean on the storied "Lady of the Green Mantle"; searching in the clear waters of cove and bay, like a bobbing duck, for rare marine shells; exploring jungles of tamarind and bamboo, wading through saw grass and custard bushes, and losing himself in groves of satinwood; racing ahead of an oncoming hurricane in a bark so light it "shivered like a leaf"; watching out the sublime and awful storm from a dank mangrove swamp; discovering, with that relish known only to the ardent naturalist, a bird entirely new to science; and enjoying the charm and hospitality of the Key West citizenry in a day when lavishness and generosity marked their relationships with their fellow man.

It must have been a rich, heartwarming, rewarding interlude for one who had recently lived through a series of harassing, discouraging experiences and had made his way southward drained of earlier enthusiasm, on a dogged mission that lacked the buoyancy and spontaneity that had companioned him in his youth.

In London, where he had found himself with a lone sovereign in his pocket and where, by his own confession, he did not know of a single individual from whom he could borrow another, he had resolved to return to the United States and make the first definite step toward exploring the Florida Keys. Before this was brought about, however, $40,000 had passed through his hands for the completion of the first volume of his *Birds of America*. Four years had been required to bring out that volume, and in that time fifty of the subscribers, representing the sum of $56,000, had abandoned him. "With all my constant exertions, fatigues, and vexations," he wrote Lucy, his wife, from England, "I find myself now having but 130 standing names on my list."

Tantalizing rumors had come to Audubon most of his life about the rare and diverse bird life to be found in the southeastern woods and hammocks and beaches of the United States, especially along the coasts of the fabled Keys. These magic isles were known more for their smugglers and pirates and

▼ KEY WEST as it looked to Audubon in 1832: an early view showing the water front at Duval Street



▼ THE "OLD GEIGER HOUSE," where Audubon was a guest during his stay in the "southernmost city" in 1832. This was once the home of Captain John Geiger, licensed pilot of a wrecking vessel in Key West, Florida. The house was built from wood floated over originally from the near-by Bahamas and is still a distinguished and handsome residence

Photo by Jeff Brodhead

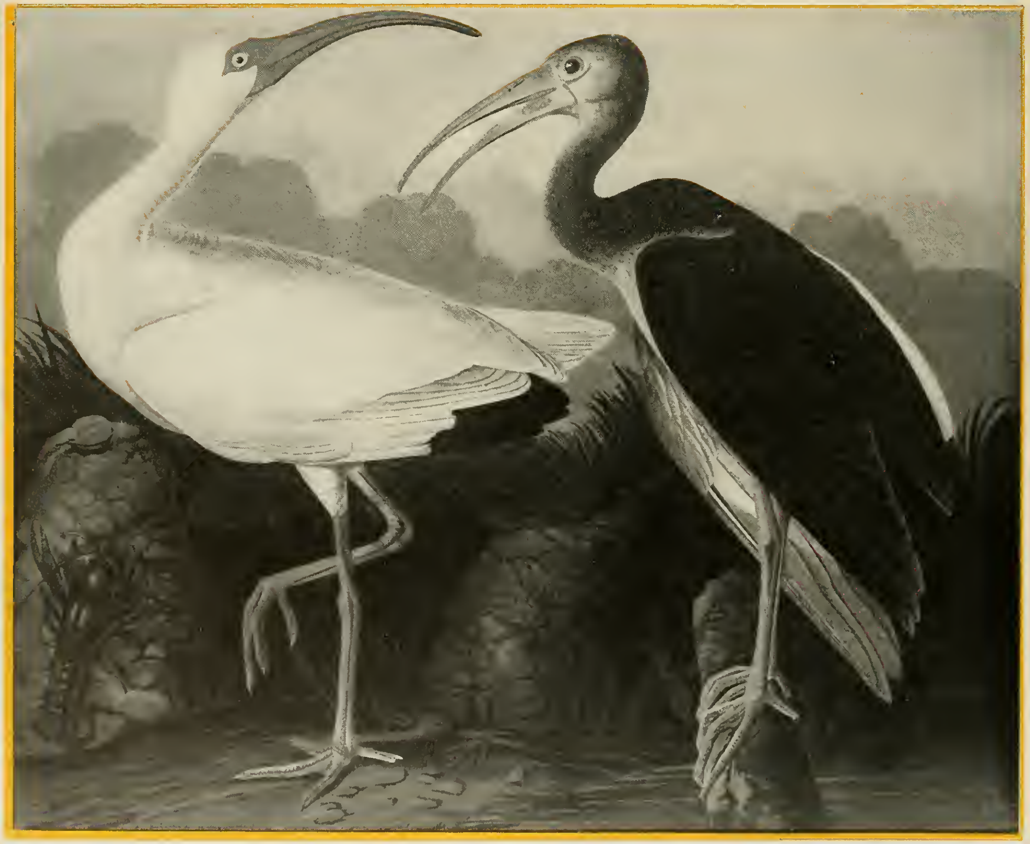
those hardened despoilers dubbed "wreckers" than for their characteristic native beauty. From the time he had known Boone in Kentucky, Audubon's imagination had been captivated by the possibilities these secluded islets might hold for scientific exploration. The "stupendous task" to which he had dedicated his life had driven him at one time or another mercilously down the Ohio and Mississippi, back to Louisiana, in and out of an unsuccessful business enterprise and a variety of uncongenial and makeshift jobs. The lean, hard years had worn his hopes thin and taken the edge off his ardor. Frustration after frustration marked his efforts, yet he had never relinquished his resolve to discover, study, catalogue, and paint America's birds.

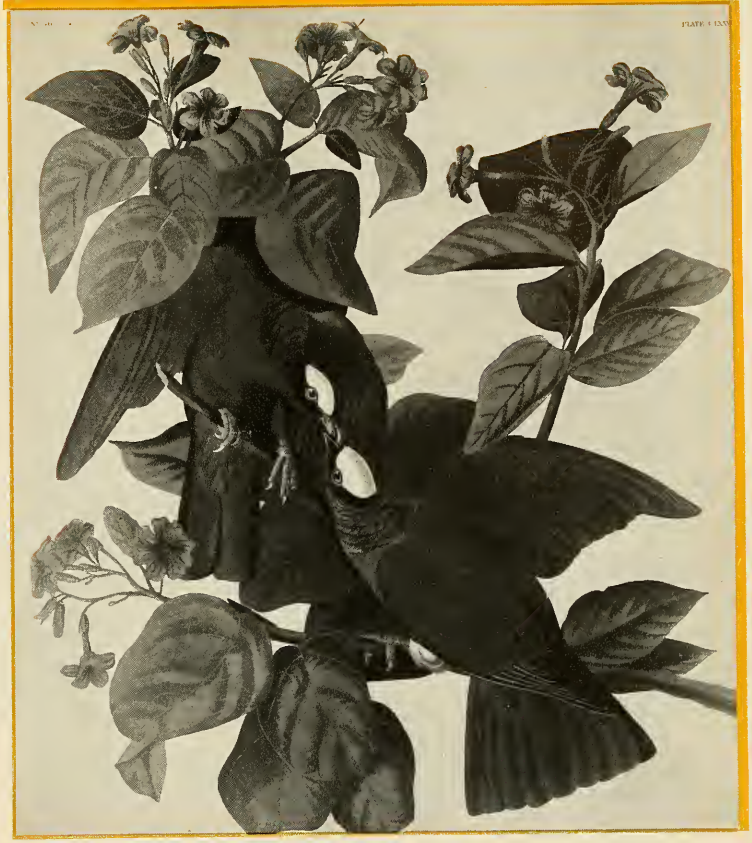
At this period of his life he had grown dissatisfied with earlier work and had decided that some 50 of his paintings were not good enough for publication. Among other things, he wanted a wider representation of water and wading birds. So his dream of the Keys grew lively in his mind, and in 1832 he waited in St. Augustine to take the first step toward its realization. A government ship had been promised for the projected trip. The schooner would convey him to the Keys and, once there, put smaller craft at his disposal as his needs crystallized. But the schooner failed to show up, and he was forced to spend four grueling months of expectant waiting, knowing that he might be stranded for years, so infrequent was the passage of coastwise vessels.

He spent the period as profitably as he could, collecting more than a thousand bird skins and hundreds of rare Florida shells and adding a number of paintings of bird life to his expanding portfolio. At length, friends in Washington arranged for a revenue cutter that was headed for the Keys to pick him up.

The day he stepped aboard the "Marion"—known to smugglers and wreckers of the Florida coasts as "The Lady of the Green Mantle"—he entered upon what was perhaps the most keenly enjoyed and profitable adventure of his life. When he caught sight for the first time of that chain of islands flung like a shimmering green scarf upon the blue waters of sea and gulf, the last vestige of discouragement slipped from him. He saw the elusive Keys as a strange and challenging new world

▼ The White Ibis, a beautiful bird that entranced Audubon when he saw it in great abundance on his expedition to Sandy Key. Drawn from nature by John J. Audubon





▲ Of this beautiful bird, the White-crowned Pigeon, Audubon said, "How can I ever hope to paint it?" This reproduction of Audubon's painting shows the bird on stems of a plant Audubon named the Geiger flower, in honor of his Key West host, Captain John Geiger. He found the flower in the garden of his friend, Dr. Benjamin B. Strobel, an early settler of Key West. This "rough-leaved cordia" is still the "Geiger flower" to Key Westers

—his to explore at will and to study and observe and enjoy. Approaching Indian Key, he leaned breathless across the rail to look down into the dazzling coral reef that glittered beneath the blue-green water. Once ashore, he walked with the tremulous expectancy of the discoverer amid strange leaves and palms and brilliant flowers. He trailed inquiring fingers over the silvered surfaces of the sea grape's leaves, clustering in sandy stretches along the shore, and peered into the mangroves that stood on croquet-wicket feet above the shallow waters of the coves.

Enchanted with all he saw and heard, he spent hours idling along the shallow lagoons that were dark with violet shadows. In deeper waters he traced the angelfish's feathery plumes, the green and scarlet flashes of the parrot fish, the fragile lavenders and blues and pinks of the water fans and gracefully waving sea anemones, the sudden sheen of the shell of a conch trundling across the floor of the sea. And above him and around in every direction wheeled and cried and whirred thousands of birds, and thousands more nested or stalked or fed or chattered in the swamps, along the shores, in the heart of the thickets. It seemed to Audubon that the world of bird life had opened for him here, and he felt his own inadequacy in face of its countless kinds and numbers. Later, in Key West, contemplating the lovely white-crowned pigeon, he asked despairingly, "How can I ever hope to paint it?"

Photo by Allan D. Cruickshank, National Audubon Society

▲ Because the White Ibis lacked the nuptial plumes that nearly sealed the fate of the egrets, and now that the Everglades National Park offers sanctuary to it, this bird is holding its own

These Keys were to prove a magic world to him. They were to restore to him his youthful enthusiasm, sharpen his awareness as a scientific observer, and provide the stimulus he needed so sorely to give fresh and glowing expression to his genius. Out of his experiences here, his sketches were to take on something more than their customary precision of line or nicety of detail and color. They were to capture in a measure the very atmosphere of the Keys and of that diffused light that plays across their wet sands, glittering beaches, and translucent areas of water. His snowy herons and egrets, his sandpipers and cormorants and curlews and ibises, caught the sheen of it on breasts and wing tips and crests, and his paintings came to life.

Much of the color and excitement of Audubon's stay in the Keys resulted from a peculiar situation existing there at the time. When civil government was established in the newly purchased Territory of Florida in 1822, the United States authorities found that a veritable hornet's nest of rough seamen were conducting a flourishing business on the Keys, in an enterprise known as "wrecking." Many of these seamen had come originally from the Island of New Providence—a Bahaman rendezvous that had harbored many pirates in its time. Nassau was the center of a system of maritime theft and hijacking backed, in many instances, by merchants of the town. These individuals built, bought or equipped vessels and sent them out, manned by unsavory characters for the most part, to prowl under signed articles not unlike those of the old-time buccaneers. Payment was on a share basis, with part of the proceeds going to the outfitter or owner and the other half divided between captain and crew. The government of the islands appropriated about 35 per cent of the gross sales of the property brought in, under guise of government duties, admiralty fees, tithes to the resident governor, and a variety of other charges.

The wrecking grounds for these groups extended down the entire irregular line of the Keys to the Tortugas, but the favorite grounds were around Key West and Key Tavernier. Some 50 vessels made Tavernier their rendezvous, for the coral bar known as Carysfort Reef due east of there was a constant danger to seamen in those uncharted waters. Here the winds, tides, and currents played into the hands of the wreckers. They lurked in a small harbor just inside the reef and waited for their prey. If the fees they set for piloting distressed ships to safety were rejected, they had only to wait for the master to run aground, whereupon they would strip the vessel clean. The loot was more valuable, in any event, than the fees asked for piloting, though the fees were considerable. Sometimes between $2000 and $3000 were wrung from unfortunate mariners. Charles Vignoles, the United States Government surveyor who visited the Keys in 1823, reported that duties paid the British government alone were estimated to average more than £15,000 annually—about $75,000 at the time.

As may be expected, the activities of these wreckers extended in slow seasons beyond pilotage and the stripping of wrecks. They engaged in smuggling on the side and were not at all above promoting shipwreck when spoils warranted. Many spent their time in off-periods treasure hunting in the waters off Key West, where the timbers and galleons sunk in Spain's heyday were still visible in the clear waters of the reefs. Farther north they sought the treasures of dead pirates, who were known to have buried their loot among the Keys.

In 1823, Commodore David Porter was sent to Key West, charged with the mission of ridding the Caribbean of pirates. With the aid of small light-draft schooners and five twenty-oared barges towed by an old New York ferryboat, Porter eventually captured the last remaining buccaneers and opened the island to settlers.

The wreckers from the Bahamas and Cuba had been accustomed to convey vessels and cargoes from the Florida reefs to Nassau and Havana for adjudication of salvage claims. After Florida was ceded to the United States, Congress, on March 3, 1825, passed a law prescribing that all property taken from a wreck in these seas, or from any of the Keys or shoals within the jurisdiction of the United States on the coast of Florida, should be brought to some port of entry within the jurisdiction of the United States. In good years, thereafter, sales in connection with these goods ran up to as much as $1,500,000. By the time Audubon visited Key West in 1832, the city could boast the highest per-capita wealth of any city in the country.

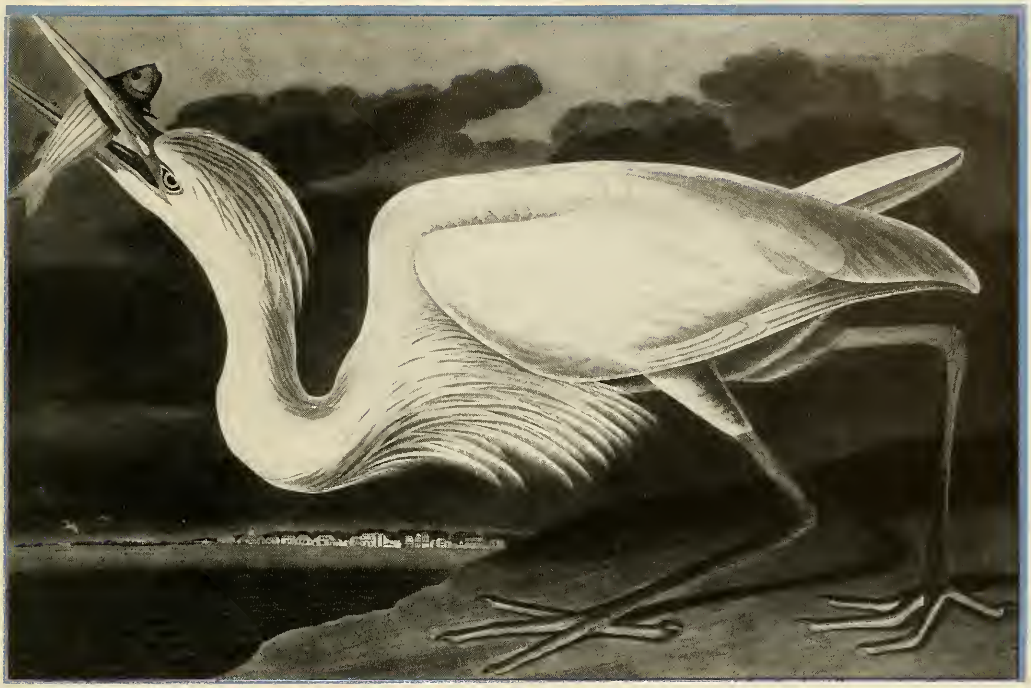
By that time, however, the business of wrecking had undergone something of a change from the old buccaneer days. In the early days vessels had sailed with skeleton rations—a few barrels of salt pork and hard tack—and the crews had had to subsist mainly by fishing and hunting. Bona fide salvors were now licensed. Conditions had improved to such an extent, in fact, that Jefferson Browne could write of this period: "Those were the happy, insouciant days! The wrecker's life, though full of danger and hard toil at times, was jolly and carefree. Their crafts were well victualled and apparelled, and they would lie all night in safe anchorage, but be underway at daylight to cruise along the reef, on the lookout for vessels in distress. When one was found, as was an almost daily occurrence, it was 'all hands to work' night and day to relieve the ship before heavy weather would drive her further on the reef or cause her to bilge. When that catastrophe occurred, the cargo was saved by men working waist deep in water and afterwards by skin-diving."

It was from these same wrecks that Key West derived some of its first citizenry. Many a gentleman of family and means was shipwrecked in the vicinity and brought safely ashore by the salvors, only to develop a permanent interest in the island. When Audubon came to Key West in 1832, he was entertained by many of these gentlemen and their families in their fine houses; he also numbered many of the respectable "wreckers" among his friends.

As a matter of fact, he made his headquarters during his stay on the southernmost island at the home of Captain John Geiger, who was pilot of a wrecking vessel—a man described by a contemporary, Judge William Marvin of the newly established district court, as "a man of decided character and sort of commodore among his compeers."

Another good friend Audubon made in the thriving little city was Dr. Benjamin B. Strobel. It was in Dr. Strobel's yard that he found the plant known botanically as the "rough-leaved cordia"—"the Geiger flower" of the Key Westers. Upon its bough he painted his famed white-crowned pigeon.

Audubon was charmed and astonished by the friendliness and helpfulness of the wreckers. "Long before I reached the lovely islets that border the southeastern shores of the Floridas," he wrote in his journal, "the accounts I had heard of the wreckers had deeply prejudiced me against them. Often I had been informed of the cruel and cowardly methods which it was alleged they



▲ THE GREAT WHITE HERON, which Audubon discovered on Sandy Key and named *Ardea occidentalis*. It is the largest of the American herons, with a six- or seven-foot wingspread. Its entire American range lies within 100 miles of Key West. Note the old Key West water front in the background

employed to lure vessels of all nations to the dreaded reefs, that they might plunder their cargoes and rob their crews and passengers of their effects. I therefore could have little desire to meet with such men under any circumstances, much less to become liable to receive their aid; and with the name of 'wrecker' there was associated in my mind ideas of piratical depredation, barbarous usage, and even murder."

➤ FOUR YOUNG Wood Ibises at the nest awaiting food: a photograph taken at a rookery on Sandy Key, where Audubon first saw the bird

City of Miami News Bureau photo

He changed this impression soon after he arrived at the Keys. For one thing, it was the business of "The Lady of the Green Mantle" and of other ships like her to keep watch along the shores to make sure that no unlicensed ships or men were engaged in salvaging. Audubon accompanied her on one such cruise as far as the Tortugas. He later described the scene as they left the Keys. Bales of cotton were floating in the coves and far out into the Gulf. Far beyond the reef he saw the dismantled hull of a ship that had been driven there by a brief hurricane. Later, in the Tortugas, Audubon boarded a number of the wrecking vessels and admired their form, their great breadth of beam, their light draft, their neatness and smoothness, and the beauty of their rigging.

"We were welcomed on board," he said later, "with all the frankness of our native tars. Silence and order prevailed. The commander and second officer led us into a spacious cabin, well-lighted and furnished with every convenience for fifteen or more passengers." In the scene that follows we have a nice example of the common appeal of the things of nature, among people of very different temperament. The captain brought Audubon his collection of marine shells and, in Audubon's

Photo by Allan D. Cruickshank, National Audubon Society

▲ AMERICAN EGRET—a pure white bird with a wingspread of three feet or more

words, "Whenever I pointed out one I had never seen before, offered it with so much kindness that I found it necessary to be careful in expressing my admiration of any particular shell."

The wrecker captain also owned many eggs of rare birds, all of which he handed over to the naturalist, assuring him that he could easily procure a new set within a month's time. "We have much idle time on our hands on the reefs this season," the captain explained.

Audubon dined aboard and enjoyed himself thoroughly while showing the men some of his drawings. The next morning a number of the wreckers accompanied him to Booby Island, a small Key near by. They rowed with long steady strokes in small boats, racing good-naturedly with one another and passing the time in singing sea songs. Audubon's friend, Dr. Strobel, had acquainted him earlier with the wreckers' song:*

* * *

Come all ye good people one and all,
Come listen to my song;
A few remarks I have to make
Which won't be very long.
'Tis of our vessel, stout and good
As ever yet was built of wood;
Along the reef where the breakers roar,
The wreckers of the Florida shore.

Key Tavernier's our rendezvous,
At anchor there we lie;
And see the vessels in the Gulf
Carelessly passing by.
When night comes on we dance and sing,
Whilst the current some vessel is floating in;
When daylight comes, a ship's on shore,
Among the rocks where the breakers roar.

* * *

It was this group of wreckers that took Audubon on a shell-hunting expedition, and they bobbed about in the waves, diving for the finer specimens. Before the "Lady" departed, Audubon was again invited aboard the wrecker, and on this occasion he was presented with superb shells, corals, live hawksbill turtles, and a great quantity of eggs. The only thing asked in return was that he put some letters in the mail for them when he reached Charleston, for their wives "down east."

As he said good-by to his new friends, Audubon was moved to philosophize, "How different is often the knowledge of things acquired from personal observation, from that obtained by report."

Shortly after his arrival at Indian Key, a small boat had been put at the naturalist's disposal, with a pilot and some fishermen who knew these waters. They skirted Indian Key and rowed off from the Matecumbes across the Bay of Florida for some 20 miles to Sandy Key, an L-shaped island about 6 miles off Cape Sable that teemed with south Florida bird life.

When Audubon lay down to sleep the first night on the island, the water almost touched his feet, but in the morning he found the tide had retreated to such a distance that his boat lay out of the water on her side. On the exposed flats, thousands of birds were probing in the mud and the pools for food.

It was on this expedition that Audubon discovered the great white heron, whose likeness appears today on the Everglades National Park postage stamp. He named it *Ardea occidentalis.* It is the largest of the American herons, with a seven-foot wingspread. We wonder why no scientist before Audubon identified this spectacular bird. It may have been mistaken for the American egret, although the egret is a smaller bird and its legs are black instead of yellow. Or it may have been less common at the time than other large birds within its restricted habitat.

The group returned to Indian Key before sunset, and Audubon began at once to sketch some of the new birds he had seen. Not even the sailors' dance in an adjoining room of the pilot's house, with fiddles screeching through the night, deterred him. After working almost through the night, he swung himself up into a hammock on the piazza and slept until just before sunrise. By the time the sun had come up, he was already on the water, off on another expedition.

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*As originally quoted by Audubon from Dr. Benjamin Strobel's version, the Wreckers' Song was in German dialect, but it was doubtless sung in a variety of accents. Therefore, it is rendered here in plain English.

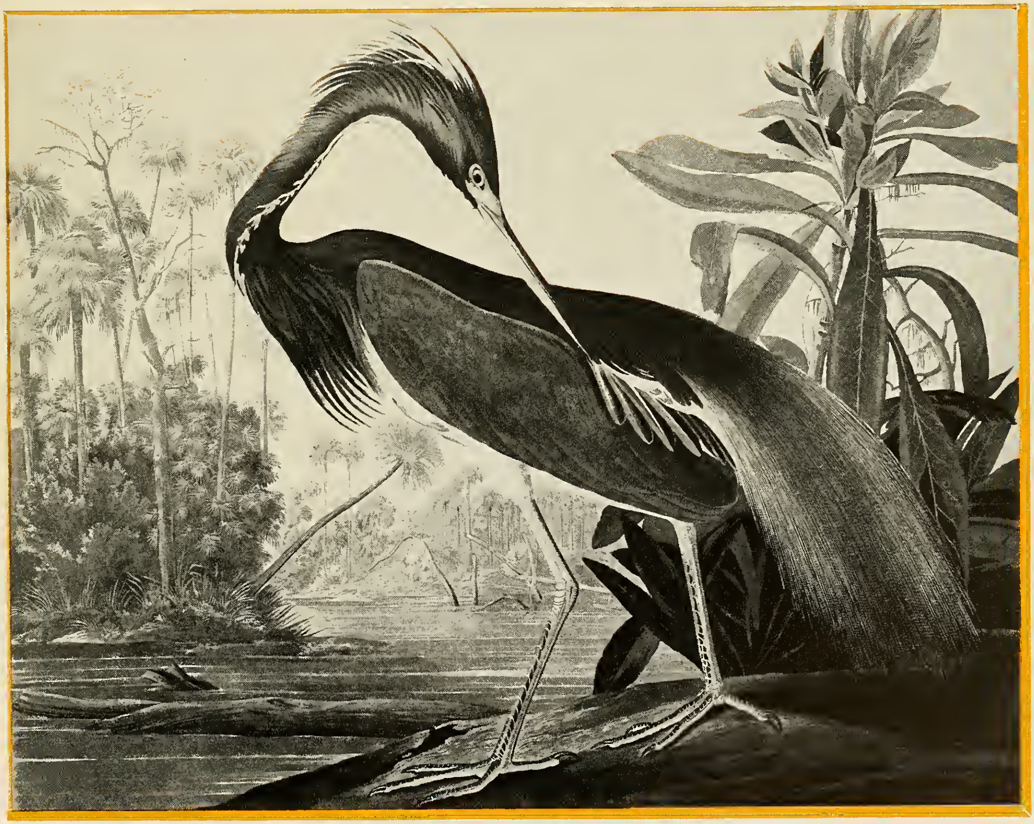
Three of the specimens Audubon gathered that day have made ornithological history. He collected a trio of European greenshanks that, to this day, have not been seen again in the United States. Another rare find of Audubon's was the Key West quail dove. It is known only from that island, and none has been seen in recent years. The beautiful zenaida dove he observed has apparently disappeared now from these regions.

On his way back to Indian Key from one of these expeditions, the sky abruptly darkened. Quickly reefing the sails, the pilot told Audubon that they "were going to get it." In the same moment sharp yellow streaks of lightning flashed across the water, striking a pair of whirling hawks, who plummeted into the sea. "A furious cloud," Audubon wrote later, "now approached, like an eagle with outstretched wings in haste to destroy us." Their experienced guide steered them across a flat to the nearest land. The blast of the hurricane struck the sides of their boat, and she "shivered like a leaf." They thought she had gone over, but the next instant, Audubon said, "She was on shore, and now, in contemplation of the sublime and

Continued on page 45

Photo by Allan D. Cruickshank

➤ **TODAY, at their rookeries in the Florida Keys, the Louisiana Herons are still an unforgettable sight. They are one of our commonest herons**



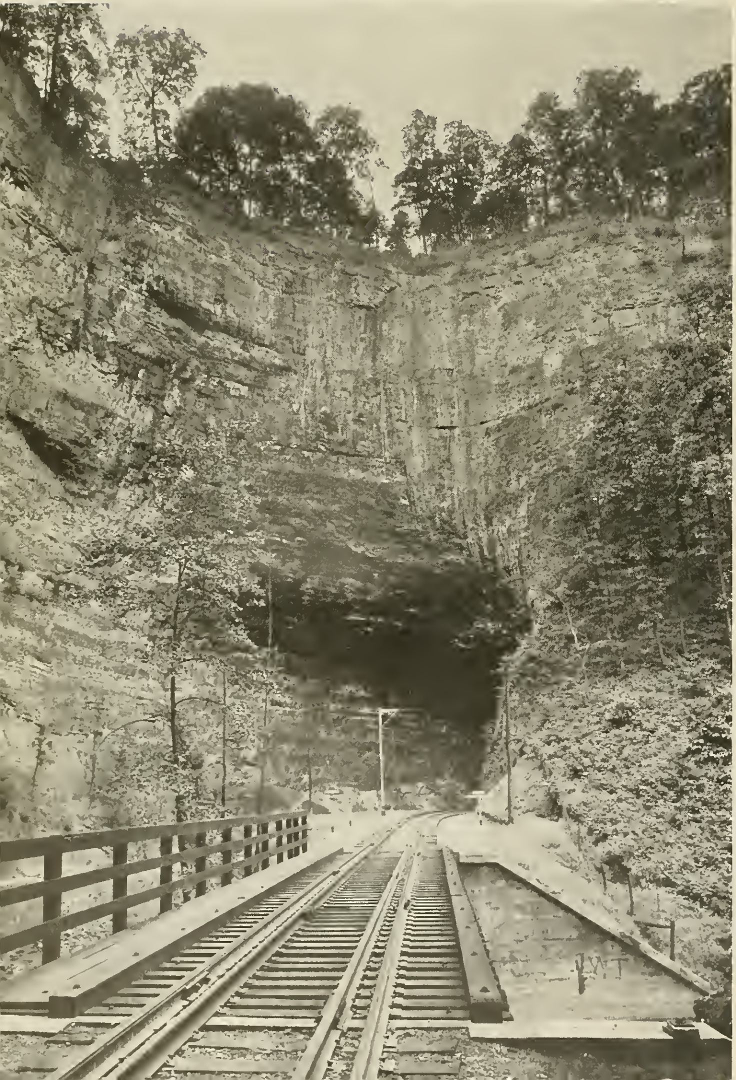
▼ THE LOUISIANA HERON, drawn from nature by John J. Audubon. He saw many thousands of these birds nesting at Sandy Key

The TUNNEL that Nature Carved

An ancient stream in Virginia shares its majestic handiwork with a modern railroad

By Dolores Butterfield Jeffords

Photo from Natural Tunnel, Chasm and Caverns Corp., Gate City, Va.



◄ This spacious "amphitheater" divides the tunnel into two sections. This is a view of Natural Tunnel from the entrance to Little Tunnel. The bridge spans Stock Creek

A NATURAL wonder that serves a utilitarian purpose is doubly a wonder—and that is the case with Natural Tunnel, in the west-central part of Scott County, Virginia, near the Tennessee boundary. Fashioned by Stock Creek on a scale out of all proportion to the size of the creek itself, the tunnel was made use of in 1882 by the builders of the South Atlantic and Ohio Railway as the most feasible route to the coal fields of that mountainous section of Virginia. The road is now a part of the Appalachian Division of the Southern Railway System.

Piercing the solid limestone of Purchase Ridge, a spur of Powell Mountain, the tunnel measures 900 feet in length, with an average height of 100 feet and an average width of 130 feet. Stock Creek flows along one side of the slightly sinuous passage, leaving ample room for the track and telegraph poles of the railroad.

To the great enhancement of the tunnel's beauty and interest, its southern end opens into a vast, circular, roofless chamber, almost completely enclosed by vertical walls of limestone and dolomite, rising from 364 feet to 750 feet above the creek level. The distance around the rim of this "crater" is estimated to be about 3000 feet. From this amphitheater, as it is called, Stock Creek goes its own precipitous way, through a breach in the walls, to join the Clinch River. Bridging the creek, the railroad track continues into another passage, known as Little Tunnel. The total length of both tunnels and the intervening crater is 1557 feet.

Passenger trains pause in the crater for the travelers to view the tremendous spectacle, which is even more overwhelming, however, when seen from the edge of the crater's rim. Track, trains, and telegraph poles seem reduced to toy size, while the passengers become tiny animated dolls, dwarfed by the height of the chasm walls and the immensity of the cavern entrance.

Like a sentinel standing guard over the open crater is Indian Head Rock, a great promontory which presents, from certain angles, an austere aquiline profile.

There is a somewhat similar but far less spectacular and well-defined amphitheater at the other entrance to the tunnel, where Stock Creek flows through a steep, narrow gorge into the tunnel. Above this gorge the creek flows through a broad subsequent valley of altogether different character; but from a point near Horton Summit it falls about 300 feet in a distance of 6 miles, to the point where it joins the Clinch River, at Clinchport, about 3 miles below Natural Tunnel.

Scientists believe that the entire gorge was once an underground waterway, of which Natural Tunnel is the last remaining roof-remnant. Probabaly the amphitheater at the south end of the tunnel was also, at some remote time, a continuous part of the roofed passage.

This natural wonder, which for many years was almost inaccessible, is now reached not only by the railroad but by north-south U. S. Highway 23, east-west U. S. 58, and U. S. 11, by connection with the private road leading to the tunnel itself. The old Daniel Boone trail of the westward-moving pioneers (now the Daniel Boone Highway) passes near by, and the roof of the tunnel provides a crossing for a country road over the gorge. Rustic paths lead to Lovers Leap and other near-by points of scenic or legendary interest. A tourist lodge and picnic and camping grounds make it an increasingly popular attraction, for the surrounding country is beautiful, and its primitive ruggedness has been to a great extent preserved.

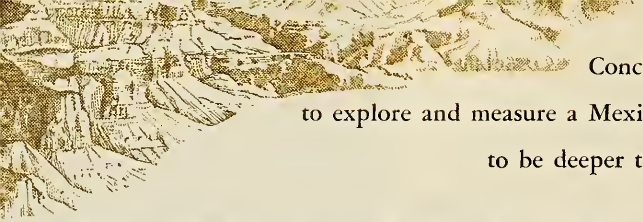
This is particularly true of the tunnel and amphitheater. Despite the accessibility of this natural wonder and its invasion by the railroad, consistent efforts have been made to retain unmarred the beauty of nature's handiwork. And beautiful it is, vast and wonderful—with little Stock Creek babbling on and on, telling in its own way of the prehistoric ages through which it labored to carve this mammoth tunnel, which it now has to share with a man-made railroad.

Photo from Natural Tunnel, Chasm and Cavern Corp., Gate City, Va.

➤ THE SOUTHERN RAILWAY approaching Natural Tunnel

▼ A VIEW OF the interior of the Tunnel showing the west wall, carved by an ancient stream whose feeble descendant promises no such heroic work

Virginia Chamber of Commerce photo



Concluding actions in the attempt
to explore and measure a Mexican canyon reported
to be deeper than the Grand Canyon

The Descent into the Barranca del Cobre

By Robert Thomas Moore
Director, Zoological Laboratory, Occidental College,
Los Angeles, California

All photographs by the author

AFTER ten days of struggle against thirst, fatigue, illness, and scorching heat, we at last were approaching a point from which our destination—the big canyon—might be reached in one long march.

We dragged ourselves into the village of Chiricahui late in the afternoon. Fortunately, I insisted on putting up the tent to protect the films, specimens, and valuable equipment, for it rained again. We were up by sunrise on the fourteenth and soon on the trail, heading generally northeast. We were determined to reach the great Barranca that day.

For some time the *cargadores* had been getting more and more surly. Juan said they demanded *fresh* tortillas. These had to be obtained or else the *cargadores* might desert us. He and I went ahead, while the others held back so as not to frighten the Indians, and when Juan saw a hut on a ridge ahead, he told me to wait until he whistled. Then he went on alone and talked with the Tarahumare and his squaw, who waited because they recognized him as one of their own race. At his whistle I went up, and Juan persuaded the squaw to cook the tortillas.

She offered me a dish of ground corn, which had an unusual slimy, yellow appearance. Juan said it was a much-prized Tarahumaran specialty and that I must eat it lest she be insulted and refuse to cook the tortillas. I had eaten queer dishes in various parts of the world, but this had the vilest taste of all. At the back of the hut, Juan showed me the hairy cases of about 100 black caterpillers, whose contents had been squeezed into the concoction. I paid for the tortillas all right!

We were following a moss-banked stream that meandered around fern-covered rocks through a primitive forest of pines, cedars, and oaks. Many rills were joining the stream, and we stopped frequently to drink their pure water, delicious after our thirst. We often passed Tarahumares plowing with oxen on seemingly impossible hillsides. One, to our surprise, was willing to have his picture taken and held his goad straight up in military fashion, but while I was focusing, the ox kicked him out of the picture. Another try was more successful.

Suddenly our trail came to an end against a great pile of logs. A Tarahumare told Juan his family had decided to plow up that side of the valley and we would have to retrace our steps and take the other side. We found the new trail a frightening ordeal for our mules, but we got through into the high forest. Here Juan lost the track, and for two miles we wandered through the forest; Jim obviously was much worried. The rain had no right to be coming so early. "If you insist on going to the bottom of the big Barranca and camping there for two weeks," he said, "the regular rainy season may start three weeks early and catch us in the canyons. A real downpour could flood the Arroyo Hondo 30 feet in a night, and we'd never get across." I knew that what Jim said was true, but I suggested we wait to see how much rain would fall in the next few days. After all, the rainy season was not supposed to begin until June 24!

We now encountered some really severe ascents, which eventually took us to 8200 feet in altitude. A large wooden cross loomed up ominously. Some unfortunate wayfarer had died there. An enormous wall of cliffs fronted us at a distance of several miles running northwest and ever higher into the sky. Descending slowly through a stand of huge pines, we came out upon an open field of great dimensions, with hand-hewn log buildings of some size on its western circumference. Juan cried that it was Churo, and the horizon to the east was the rim of the Barranca del Cobre!

We were a disheveled group of

cavaliers as we rode up to the Ranch. And Señor Mancinas' greeting, though delivered in a grand manner, did little to lift our spirits. Indeed, he took all the romance away when he asked, of all things, "Would you like to telephone to your home in the United States?" Somewhat crestfallen, we asked if it was a common thing for Americans to reach this place. No, he had not seen any for many years, but a single telephone line had just been strung to trees from Creel, three days away to the east. He had not seen Americans since the railroad engineers of the Kansas City and Mexico Railroad had come to survey the route via the Barranca to the Gulf of Lower California.

"Don't tell us," we cried, "that a railroad runs along the rim over there."

"Oh, no! The idea was abandoned as being impossible."

"Did any of the party descend to the bottom of the Barranca?"

"No, Señor, I do not think so. It is very dangerous! But my brother has a ranch part way down. You can make it that far, but the trail is worse than any you have come over."

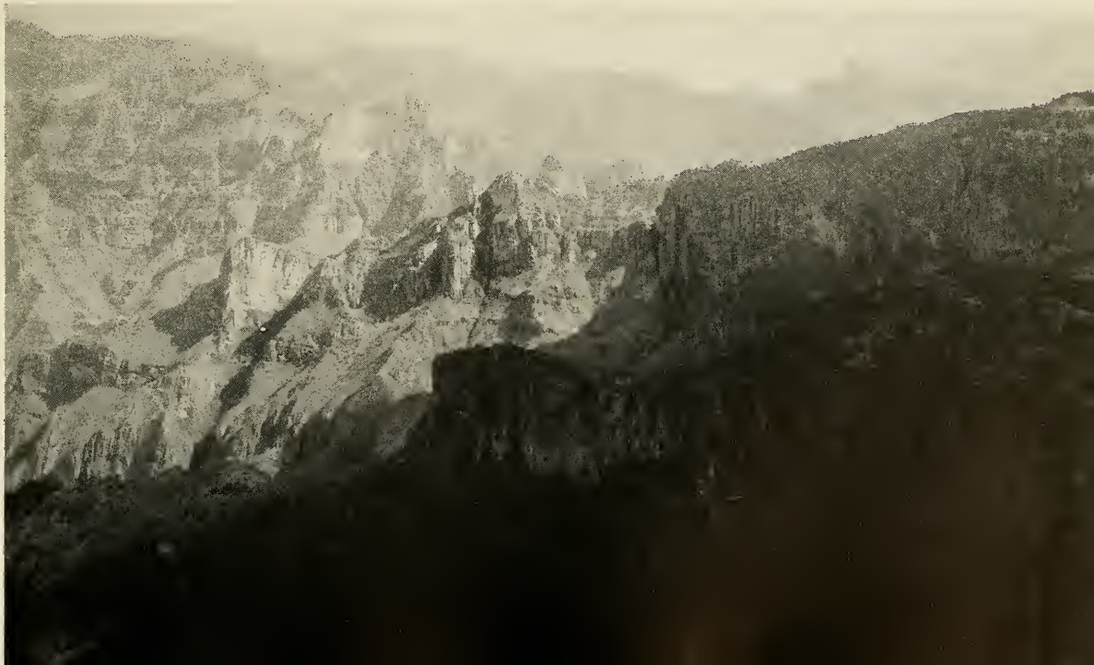
"We're going to the bottom!" I said with finality. Then I added for Jim's benefit, "Our zoological work is the most important. We hope to ascertain if the Uriqui River is being used as a migration route for birds." Jim looked at me with his quizzical expression, obviously disgusted, but said nothing.

We ate dinner on the huge stone-flagged veranda 100 feet long by 20 feet wide. Never did fried eggs, flapjacks, canned peas, canned pears, and peanut butter taste so good. I slept with Paul in the telephone room, with the open hand-hewn doorway barricaded by boxes to keep out the ravenous dogs.

The next morning, after enjoying an ancient Tarahumare fiesta enlivened by dances, we mounted our five mules and, followed by our burros, headed for the "Rim." Our first view of the Barranca del Cobre was startling enough, but the one from Jotami was surely as breathtaking as the one that caused Father Salvatierra to quake with terror. Only birds could go to the bottom from this point. As at the Grand Canyon of the Colorado, one looked down on the peaks of a vast mountain range within the barranca. But the colors were softer—none of the somber dark reds of its northern counterpart, but brown and pale yellows. Farther east we were to see sections of green. Its grandeur lay in its seemingly greater width and depth. We could not even see the bottom. A secondary canyon perhaps a mile below us, with narrow sheer walls, cut off our view of the Uriqui. Those inner cliffs would be difficult to negotiate!

We found an easier place several miles to the east, which proved to be the customary descent to the "brother's ranch." At its beginning rose a large wooden cross at whose base was a four-foot pile of stones. Juan said that each traveler added a stone and said a prayer for protection before attempting the dangerous descent into the mighty barranca.

For ten minutes we descended through enormous pines. Suddenly rounding a jutting rock, the view of the vast canyon burst upon us, and for half an hour we stood, too amazed to analyze. It was not one great canyon but a series so complicated that it was difficult to conjure any measuring unit by

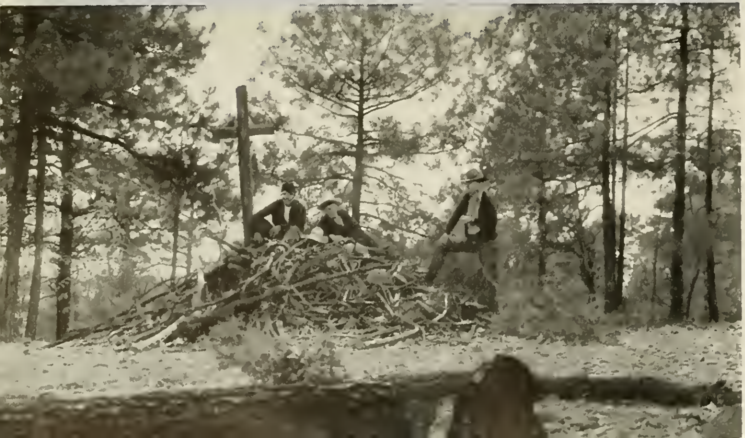


▼ THE EXPEDITION's first view of the canyon was from this point at an altitude of 8200 feet. The rim of the inner canyon is 4000 feet below

▲ ALTHOUGH DEEP IN the back country of Mexico's state of Chihuahua, the Tarahumare village of Chiricahui boasted a "cathedral." The adobe building stood in a plowed field and was roofed with hand-hewn shingles. Its round central tower of brick was covered with mortar

▲ THE TARAHUMARE Indian who a few moments before had been kicked out of the picture by his ox

▼ AT THE RIM of the canyon: a large wooden cross and a four-foot pile of stones on which it was the custom for every traveler to add a stone before making the perilous descent



which to gauge its depth and width or even to determine which was the main canyon of the Uriqui. A fine silver thread more than 5000 feet below us was finally determined to be the main river of the Uriqui system. Only one pinnacle on the south wall was definitely green, in great contrast to the rest. As a color display it could not equal the Grand Canyon's sunset canvas, but it fully equaled it in spacious majesty and intricate patterns. Was it deeper?

We began the long descent. The trail was truly terrifying and would have been impossible for inexperienced hikers. In many places the steplike rocks were so slick they threatened disaster to riderless mules even without any packs. The laden burros often slipped six to eight feet at a time. As we dropped, the intense heat of the lower canyon walls swirled up at us in torrid waves, until we seemed to be in a steaming cauldron.

Soon all desire to study or collect the objects of natural history about us was stifled, and each of us sought the shade of every small thornbush and cholla. It required four hours of suffocating exertion to reach a green spot, which proved to be the ranch of Mancinas, with its 75 orange trees enclosed by a wall. A spring above furnished irrigation. In addition to the ranch house of mortared rocks, there was a two-story hut in the orange grove, open at both ends on the second floor for ventilation. This was offered to me and gladly accepted. It proffered protection for our specimens, room for taxidermical work on the first floor, and fairly cool sleeping quarters on the second.

The usual thunderstorm that night caused mutterings from Jim about "floods," and I decided that we must make the bottom the very next morning lest Jim should insist on returning.

So at sunrise, Paul and I made a reconnaissance to the rim of the inner canyon. After several hours of searching with a Tarahumare boy, we discovered a somewhat easier slope. An hour later our sturdiest burro was careening down and balking frequently. We followed with much misgiving, slipping and sliding precariously at times, narrowly avoiding serious falls. The Indian boy, José, after it was too late, told us there was an easier route to the Uriqui several miles to the east.

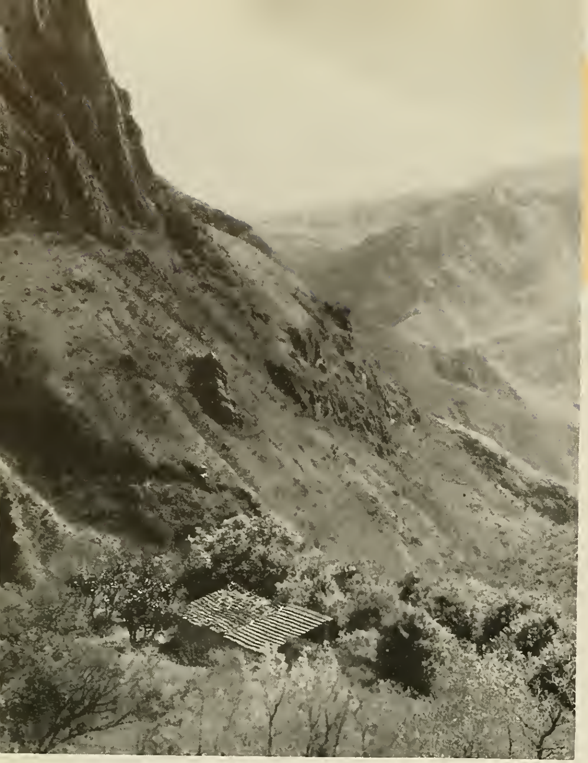
We reached the river late in the afternoon, fourteen and a half days after leaving Guirocoba, only to be greeted by another terrific thunderstorm! The detonations from the cliffs were frightening. The deluge struck before we could raise the tent, so we took refuge under a rock. Where the rain hit the hot walls of the inner canyon, it was instantly transmuted into steam. When the rain ceased, we tried to raise the tent again, only to be greeted by a new onslaught. After the tent was finally erected, it was too dark to arrange the equipment, and I had a miserable time trying to sleep on top of it with my head lower than my feet. The humid heat was stifling.

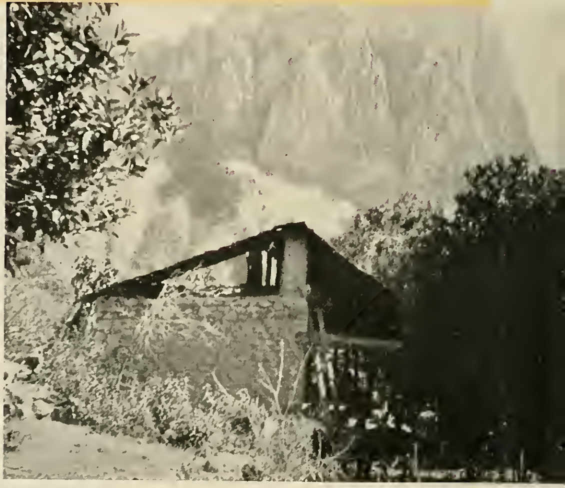
On the morning of the seventeenth, Paul and I hunted for the nests of birds, but I was chiefly seeking late migrants on the way to Texas. I had been convinced by specimens taken on the plains to the west that migrants from Texas, such as the Black-capped Vireos, go south over the plateau of Chihuahua until they reach the eastern end of the Barranca del Cobre and are then lured by the increasing warmth to descend into the barranca and follow it out onto the plains of northern Sinaloa. We obtained some new evidence to support this theory.

At sunrise on the eighteenth, we hiked down the river and proceeded for one and a half miles to a point opposite a deserted Tarahumaran *finca*. Here a fine stream dropped into the Uriqui, forming small cascades and a waterfall not visible from the river. We forded the Uriqui and climbed up the stream 100 feet on the opposite side to reach the *finca*. The clearing revealed several much neglected orange trees. Señor Mancinas had told us there had been a heavy "freeze" four years earlier, and snow for the first time had fallen at his ranch (half way up the canyon wall), banking several feet deep. The freezing conditions had killed most of the orange trees on Indian farms within the barranca, even a large grove of 1000 farther down the river.

We continued collecting downriver for another half mile when dizziness gave me warning that I was in danger from my old enemy —sunstroke. Paul and I succeeded in jumping across to "our" side of the river. It was considerably deeper than at the earlier ford, and the exertion and several falls, plus the heat, sapped my strength. I crawled under the shade of a huge rock, admitting I was too dizzy to walk. Juan, unable to make the crossing in his slippery leather *zapatos*, returned to the

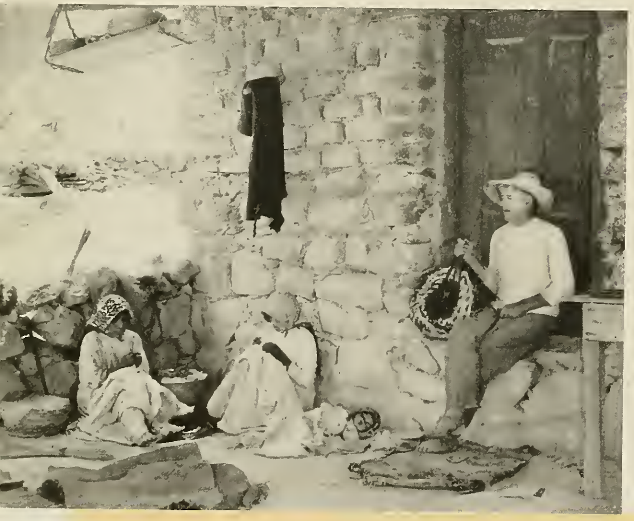
▲ JUAN ON THE WEST RIM of the Barranca del Cobre, gazing at the east rim in the distance



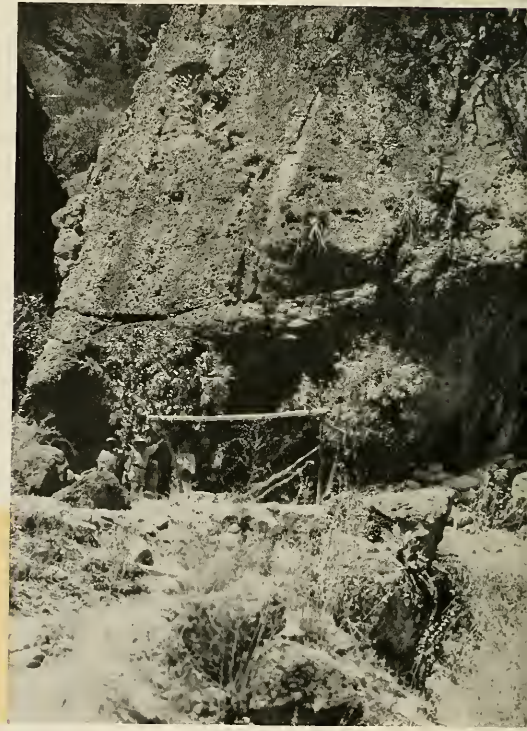


◄ The ranch and orange grove of Mancinas, 3400 feet below the rim of the canyon on a shelf extending out from the north wall

▼ The Author's headquarters in the orange grove inside the canyon



▲ Ranch of "the brother," José Maria Mancinas, who is sitting on his veranda with his Tarahumare family



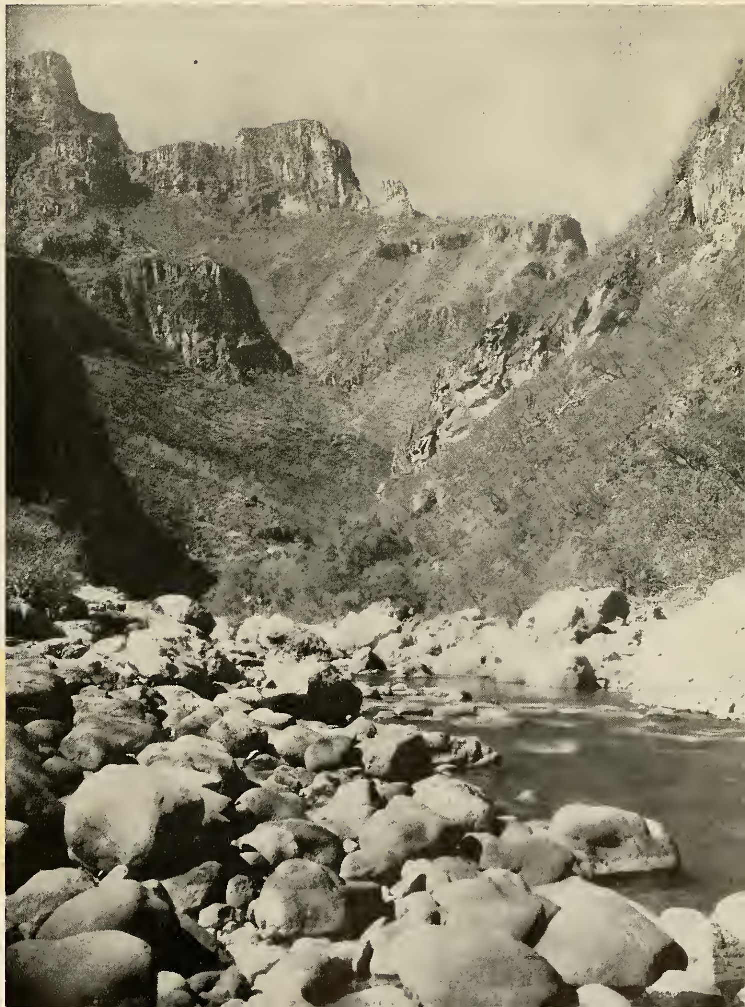
► More primitive was the home of a Tarahumare family under a huge, sharply leaning wall, a mile from the Mancinas ranch. All of the children had been born under this partially exposed cliff upper ford, shouting that he would bring the burro for me, if possible. How could he lead it through the huge boulders along the west wall!

He was gone for hours and then to our amazement appeared with the sure-footed animal. We reached our tent site by 2:30 P.M. Realizing I should not stay longer, Paul packed up the equipment, and by late afternoon we completed the 2100-foot ascent to Mancinas' Ranch at Tohuarique. Never did mere greenness look so alluring as that dark green orange grove and its shade.

As twilight fell, I mused about the depth of this majestic canyon. Miles up the barranca was an enormous cliff visible from the orange grove. It might well be Visaderio, where the Indians claimed the deepest point was located, but Jim would never agree to spend another week necessary to ascend and then make another descent. Clearly I must abandon the idea, however alluring it was. After all, the expedition had been highly successful. My one regret was that we had not brought more accurate instruments for determining the depth of the barranca. Aneroid barometers, even the best such as our large Paulins, are subject to errors due to changes in the weather. However, I had left an extra aneroid at Churo to be read each morning, noon, and night at the same time we read ours. We had determined with reasonable accuracy the difference in altitude between Churo and the high point at Jotami; and we had read the altitude of the Uriqui at the lowest point we reached, almost opposite Jotami at noon. The difference between the two readings, admittedly subject to error, gave the depth as more than 5500 feet. However, it was important to have a reading at Churo at the same time we made ours at the bottom of the Uriqui. This would give us a fairly accurate check.

Cave dwellings were not uncommon in the barranca. The most primitive one was the home of a Tarahumare family under a huge, sharply-leaning concave wall of a cliff a mile from Mancinas' ranch. All of the children had been born under the partially exposed cliff. The husband had been severely hurt recently by a fall and had to be carried 3000 feet up to Churo. As cave dwellings of the Tarahumares have been described in detail by Lumholz, the conventional kind will not be described here.

The animals got several days' rest at the ranch while we photographed the barranca from various points. By the twentieth, Jim's concern about possible floods had reached a serious pitch, a real obsession. At five in the afternoon, when a huge black thunderhead approached down the barranca, he called for a conference and insisted we start our return trip in the morning. Paul and I wished to stay another week, to get more photographs and collect another 300 specimens of bird life. But Jim claimed that it was dangerous to stay another day and said he could no longer guarantee that the Indian cargo bearers would not desert us. He could not be responsible for the loss of 20 animals, which might



➤ WHERE THE explorers forded the Uriqui, the water was only a little above the knees. Lack of precipitation had reduced it to a third of its normal width. Ordinarily it would have been almost impassable well perish in the floods or starve to death. Up to this time, every one of Jim's prophecies had been fulfilled to the limit. Certainly his advice merited careful consideration. He knew I would be responsible for the loss of the animals, but the possibility of desertion swayed me! I had had enough of that kind of experience in the Andes.[7] So I decided to move on the morrow, May 21.

The ascent out of the barranca proved as difficult as the descent but was accomplished without loss. The important question kept ringing in my ears all the way to the Rancho: "Was the aneroid read regularly at the hours agreed on?" And I pushed my mule at his fastest pace, which was irritatingly slow. Finally I confronted Mancinas and awaited his answer. "We read them a lot of times, Señor, but not always. We were so delayed in our work on the *finca* because of the thunderstorms; but here they are —I am sure they are accurate."

I grabbed the notations and looked for the vital reading at noon of the eighteenth of May. *There was none!* He had read it only for the morning and evening hours, and a thunderstorm had intervened, eliminating the evening reading as almost valueless. Even the morning one was taken four hours earlier than ours at the lowest point. All we proved was that the Barranca del Cobre was very deep, almost surely over a mile. There was some consolation in the realization that the determination of the depth at any one point would never provide data for a real comparison with the Grand Canyon. At least two months would be required even for a regular surveying party with the proper instruments to obtain authoritative data. The barranca is reported to be 100 miles long. Furthermore, we were told that the Barranca de San Carlos of the southern branch of the Uriqui-Fuerte system is believed by some to be the deepest canyon of all.

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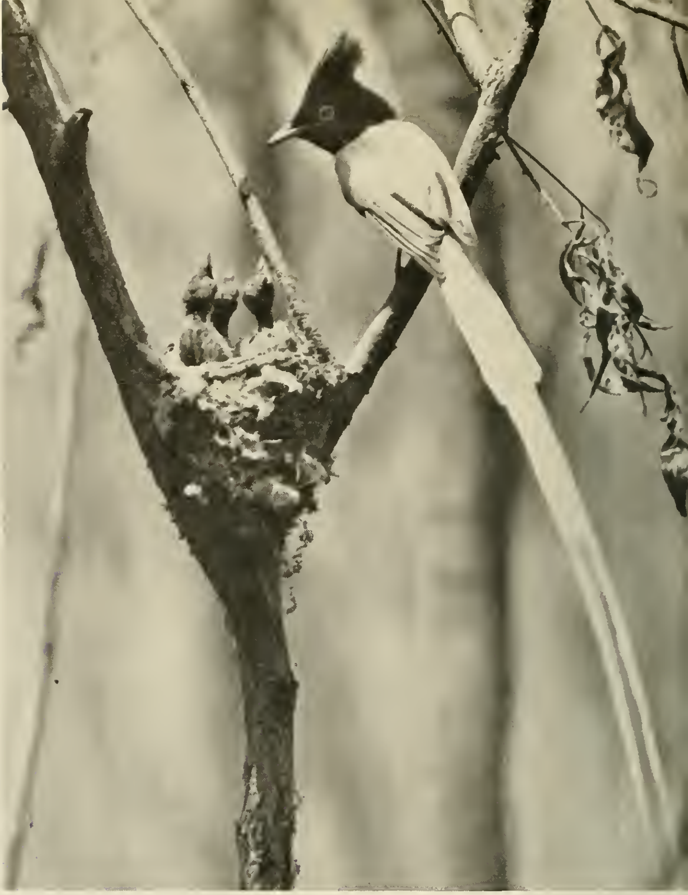
[7] See "The First Ascent of El Sangay" by the author in NATURAL HISTORY for May and June, 1950.



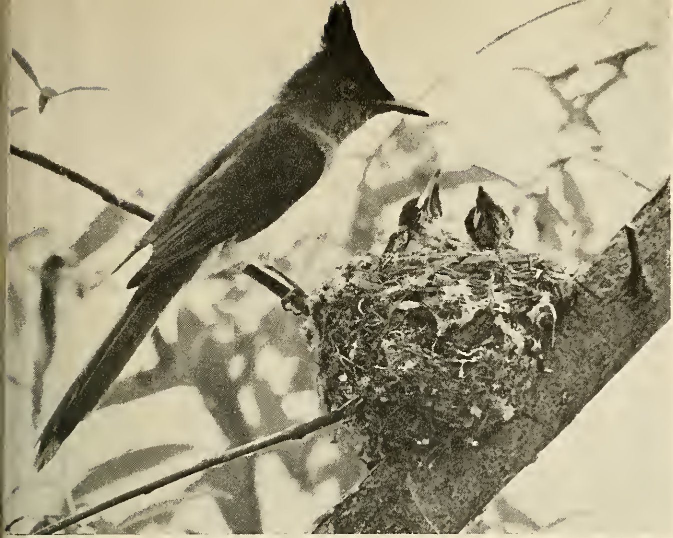
▲ IN FLIGHT, the long tail undulates horizontally behind the bird. This cock was brave enough to feed the chicks as soon as the photographer set up his blind, but individuals varied considerably in this respect

THE *Paradise Flycatcher* IN KASHMIR

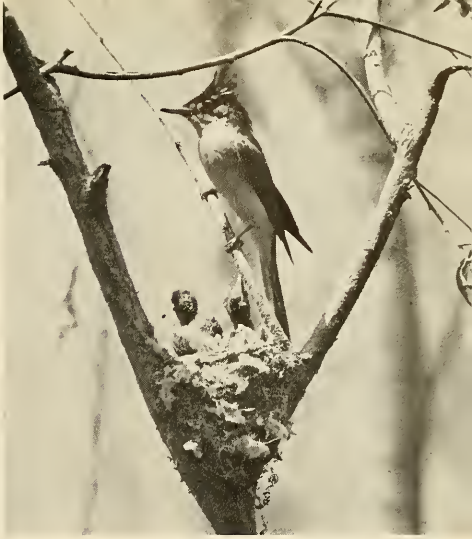
One of the prettiest sights in this fairyland of lakes and mountains is a tiny bird with a long trailing tail

By LT. COL. C. L. BOYLE

Secretary, Fauna Preservation Society



▲ THE NEST of the Paradise Flycatcher is a neatly woven cup placed in the fork of a thin stem or branch. The female, lacking the long tail, has a bright chestnut back and tail and pale underparts. Both sexes share in incubation and feeding

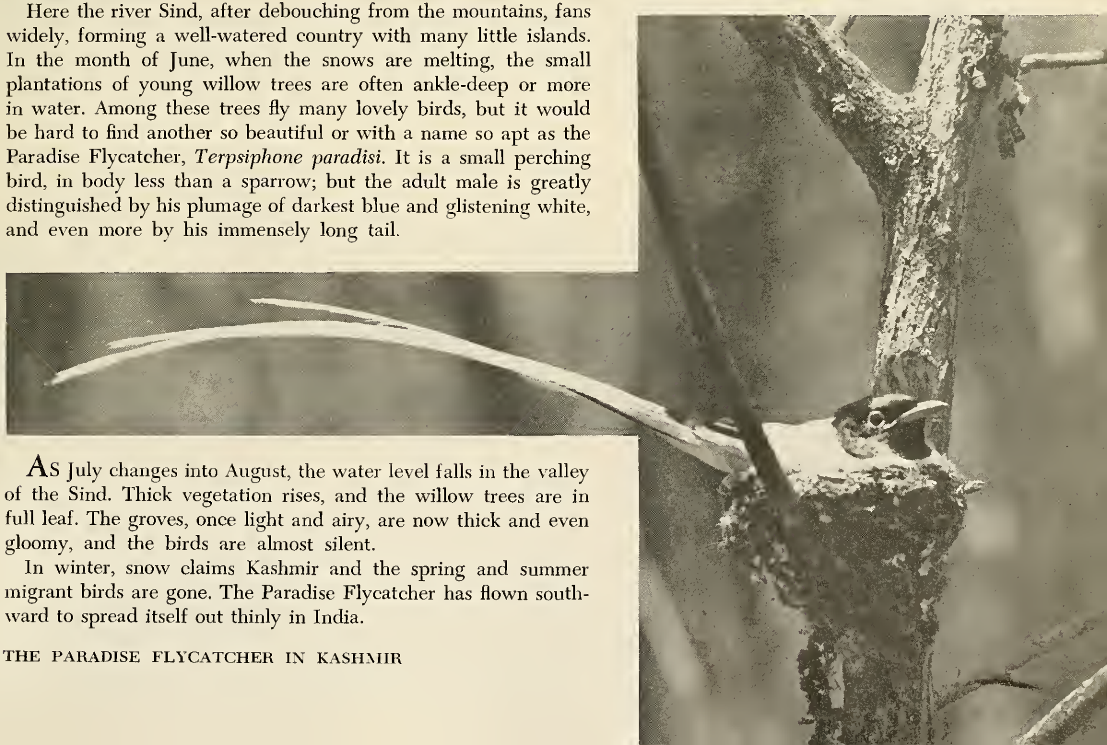


▲ TRUE TO ITS NAME, this flycatcher feeds chiefly on winged insects. Dragonflies somewhat too large for the tiny gape are sometimes offered to the young, but the parent never thinks of serving the insects piecemeal. After futilely trying to cram the oversized insect down the throat, the adult will fly off to devour it elsewhere; even the limited capacity of a chick's throat has its compensations

SETTING out from Lahore by automobile or bus, the traveler crosses the plains of the northern Punjab for 100 miles and then passes through the magnificent gorges of the Chenab. At 9000 feet he reaches the snowbound Bunhal Pass. Then he drops swiftly 4000 feet into the vale of Kashmir. The road he follows is now girt with aspiring poplar trees and rice fields, and beyond Srinagar there is a wealth of lakes and rivers, surrounded by mighty mountains.

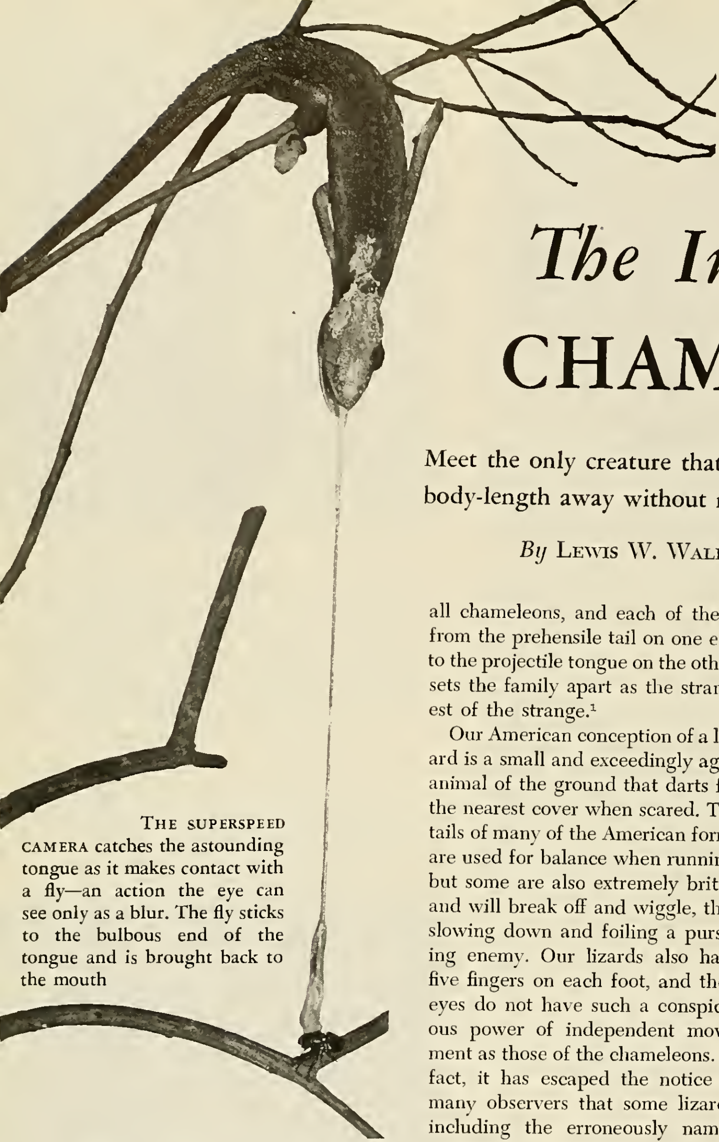
Here the river Sind, after debouching from the mountains, fans widely, forming a well-watered country with many little islands. In the month of June, when the snows are melting, the small plantations of young willow trees are often ankle-deep or more in water. Among these trees fly many lovely birds, but it would be hard to find another so beautiful or with a name so apt as the Paradise Flycatcher, *Terpsiphone paradisi*. It is a small perching bird, in body less than a sparrow; but the adult male is greatly distinguished by his plumage of darkest blue and glistening white, and even more by his immensely long tail.

▼ GRACEFULLY POISED on the nest, this male is not unwilling to share family responsibilities. But some of them were observed to leave most of the heavy work of feeding to their mates



AS July changes into August, the water level falls in the valley of the Sind. Thick vegetation rises, and the willow trees are in full leaf. The groves, once light and airy, are now thick and even gloomy, and the birds are almost silent.

In winter, snow claims Kashmir and the spring and summer migrant birds are gone. The Paradise Flycatcher has flown southward to spread itself out thinly in India.



THE SUPERSPEED CAMERA catches the astounding tongue as it makes contact with a fly—an action the eye can see only as a blur. The fly sticks to the bulbous end of the tongue and is brought back to the mouth

The Incredible CHAMELEON

Meet the only creature that can capture its prey more than a body-length away without moving anything except its tongue

By LEWIS W. WALKER *and* G. E. KIRKPATRICK

IF a handful of miscellaneous parts were random-picked from various animals, then assembled in the general form of a lizard and adorned with the mechanical turrets of a tank to act as eyes, the resulting creature might resemble a chameleon.

There are some 80-odd species of these outlandish reptiles, each with its own specialized set of gadgets in the form of horns, bony shields, and fantastic helmets. However, many strange anatomical features are standardized equipment for almost all chameleons, and each of these, from the prehensile tail on one end to the projectile tongue on the other, sets the family apart as the strangest of the strange.[1]

Our American conception of a lizard is a small and exceedingly agile animal of the ground that darts for the nearest cover when scared. The tails of many of the American forms are used for balance when running, but some are also extremely brittle and will break off and wiggle, thus slowing down and foiling a pursuing enemy. Our lizards also have five fingers on each foot, and their eyes do not have such a conspicuous power of independent movement as those of the chameleons. In fact, it has escaped the notice of many observers that some lizards, including the erroneously named "chameleon" of circuses (the American anole), can follow more than one object at a time. At best, however, their ocular maneuvers are very modest compared with the manner in which a true chameleon can swivel its turret-mounted eyes independently, which is a sight to behold.

The chameleons are one long contradiction to our general conception of a small four-footed reptile. Instead of a rear appendage so inconsequential that it can be lost at a moment's notice and regrown at leisure, the chameleon's tail is a delicate organ, fully equipped with muscles, nerves, and a sense of feeling. When the animal is on a flat surface, the tail is carried neatly curled and partially protected against the body, but when in the branches of trees its tip-end constantly wraps around twigs to prevent a fall. In a sense, this prehensile tail gives the lizard an added hand for its aboreal existence.

Life in the branches has also brought about a peculiar development of the feet and a strange placement of the toes. Instead of a hand with five separate fingers, the chameleons have their fingers almost fused together, two on the outside and two inward—an adaptation perfected for the grasping of small branches. And these little tonglike hands are set at right angles to the line of the body. The rear legs are somewhat similar but have the toes fused in a reverse arrangement.

The chameleon's use of its legs, body, and prehensile tail could best be described as slow motion. Every action is deliberate and drawn out, whether it is the releasing of one branch or the gripping of a new one. But this lethargic demeanor stops with the eyes, as they rotate independently in their peculiar tur-

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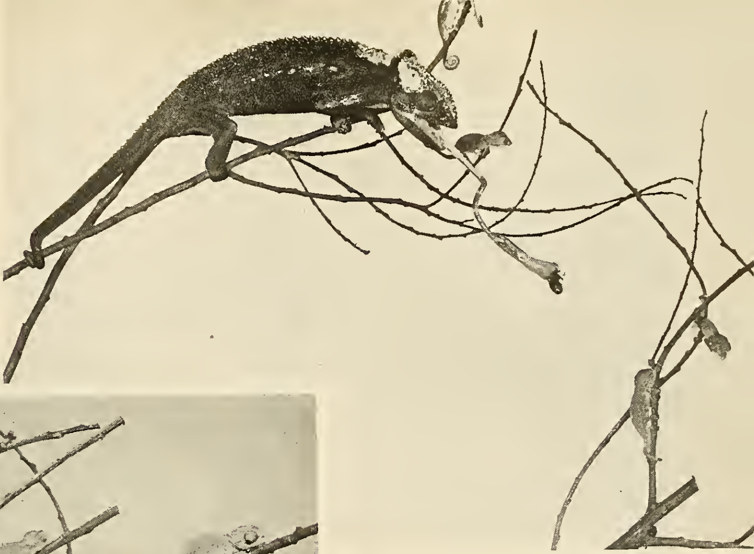
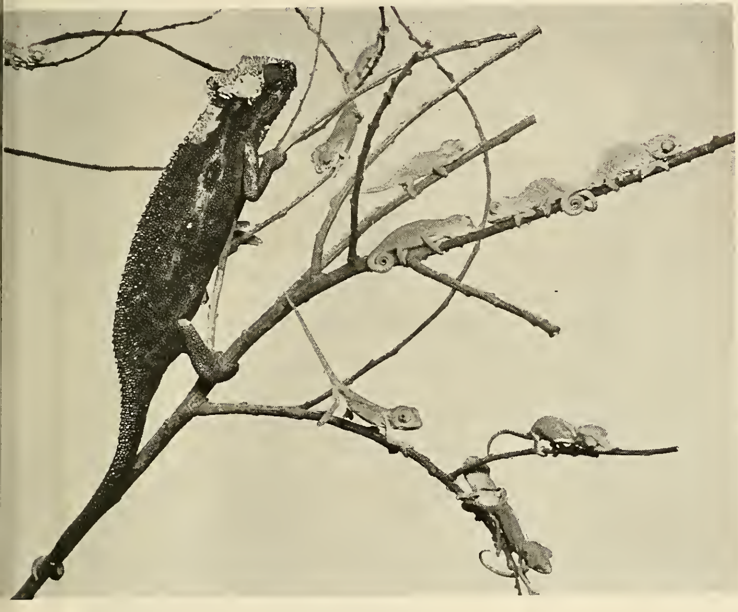
[1] The "dwarf forest chamelons" (*Rhampholeon*) lack the prehensile tail.

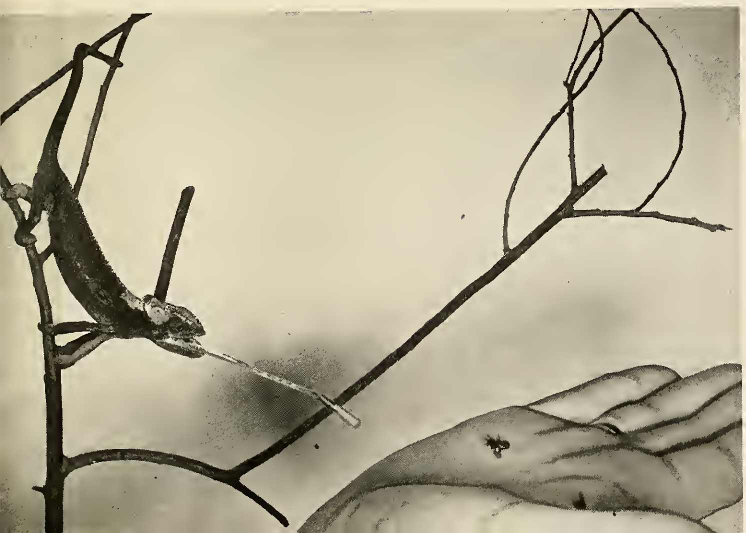
➤ THE TONGUE becomes limp when it contracts into the mouth. Notice the newly hatched young, which used their tongues with full efficiency on fruit flies within a few days after birth. No attempt was made to feed them at birth



▼ THE 24 YOUNG were born in thin membranes soon after the mother chameleon arrived at the San Diego Zoo from Cape Town. But not all chameleons are born in this way. Some are reported to lay as many as 50 eggs in a hole painstakingly dug in the earth



▼ THOUGH THE CHAMELEON was newly arrived from South Africa, it was soon willing to take food from the hand. This species is *Microsauria pumila pumila*

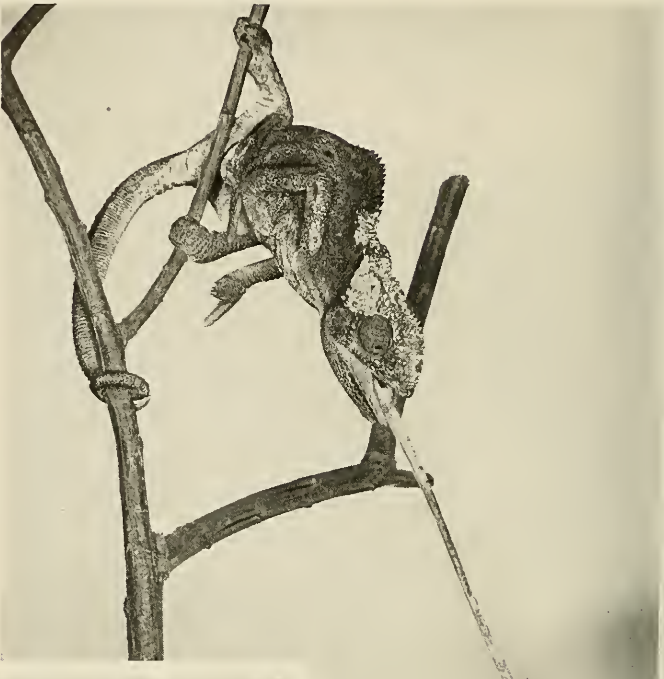


ret sockets. These unique organs project prominently from the sides of the head as cone-shaped tubes, capable of revolving in any direction. The eye is located at the outermost point of the cone, making it possible for a chameleon to see his nose, forehead, and perhaps even his other eye without undue strain. Usually, while one optic is scanning the ground below for possible enemies, its companion is searching the branches above for insects, but they work in unison when tasty prey is sighted.

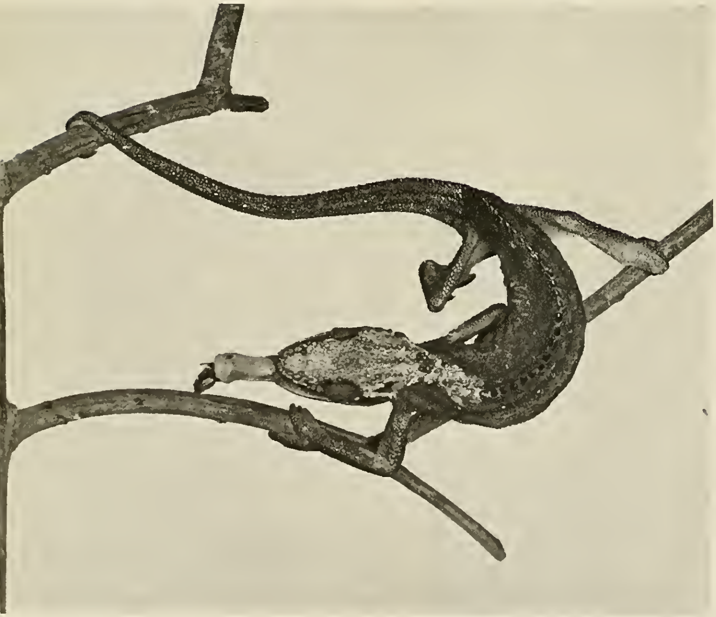
This can be a fly, beetle, or worm —and as far as ten inches away from a six-inch lizard. If beyond this distance, then one eye will keep the food in focus while the other selects branches upon which to effect a cautious slow-motion approach. When the range is right, the two eyes again swing to the front and the mouth of the lizard opens. From this point on, human eyes record only a blurred image of what takes place. The insect, completely unaware of danger, disappears from the branch and dangles instead on the sticky end of a string-like tongue. The outthrust is lightning-like, but the return to the mouth is slower and can be watched as the tongue, like a limp rubber band, contracts and thickens and pendulously swings as it disappears within the open jaws, with the bug still held captive on the bulbous end.[2]

The word "chameleon" is almost synonymous with changing color, and these strange old-world lizards are past masters of this art. However, the color changes are not necessarily governed by background. In some instances a green lizard on a green background can be frightened into assuming a color that is completely nonprotective. No doubt many of the changes are emotional and are just as difficult to control as a human blush.

The chameleon pictured in the accompanying strobolite photographs was sent by plane to the San Diego Zoo from Cape Town, South Africa, and soon after arrival gave birth to 24 young. Each was a perfect replica of its mother, with the exception of the scaly head ornamentations that probably denote maturity. They were born in thin membranes which were laid on a branch, but in their immediate struggle to escape they fell to the floor of the cage before breaking out. On emergence, wet and sticky, they sedately walked to the base of the cage tree and ascended to the higher branches. There, with tiny tails wrapped around twigs as though mimicking their unconcerned mother near by, they seemed to have complete confidence in their ability to control their strangest of equipment.



▲ Its turret-mounted eyes swivel independently. But when the tongue shoots out, they both concentrate on the target, probably to gauge better the direction and distance



◀ A stickiness holds the insect to the tongue while it is drawn into the mouth

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[2] For a description of how the chameleon's tongue can perform this remarkable feat, see "The Most Amazing Tongue in Nature" by Robert Cushman Murphy, Natural History, May, 1940.

WITH AUDUBON IN THE FLORIDA KEYS

Continued from page 31

awful storm I gazed around me."

The naturalist's description of the brief hurricane is a vivid one.

"The waters," he wrote, "drifted like snow; the tough mangroves hid their tops amid their roots, and the loud roaring of the waves driven among them blended with the howl of the tempest. It was not rain that fell; the masses of water flew in a horizontal direction."

It was on his birthday, May 4, 1832, that Audubon arrived in Key West, the southernmost Key. The little newspaper published on the island stated that the day was the "fifty-second anniversary of his birth." If this were true, the date is significant, for the various dates given as his birthday do not always coincide. The naturalist himself sometimes gave one date, sometimes another, and was deliberately mysterious or ambiguous about the place of his birth. He appeared to enjoy keeping alive the rumor that he was really the Dauphin of France, who had been spirited from that country during the French Revolution and was said to have been brought in infancy to the United States.

Audubon enjoyed Key West, with its bustle and excitement, occasioned by the salvaging operations, the influx of the rescued, the activity around the docks, and the chatter of the seamen who swarmed the streets. During the time that he knew it, Key West was filled with people from many countries, and many languages were heard in its shops and on its streets.

The well-to-do families who had made their homes here lived a gracious and leisurely existence, enriched by the luxuries the waves washed up on their reefs. The early settlers had chosen to build on the ridge of land on the deep-water side of the island. Although the island was but two miles wide and four miles long, much of its central area was given over to a big swamp having an outlet to the sea. Carts and carriages had to make their way over bridges, and there were catwalks for pedestrians. The depth of water in the "pond," as the citizens called it, varied with the ebb and flow of the tide. They were restrained from filling it in for fear of hampering the movement of the tides and inundating the residences. In the fall of 1831—the year before Audubon appeared on the scene—the city council had adopted a resolution to allow inhabitants to remove the woods then standing on Eaton Street. From Duval to Simonton streets the trees were cleared, but beyond this point the thick growth of primeval trees still stood. Wood and brush were cleared on that portion of the island lying between Whitehead and Elizabeth streets as far out as Fleming. In the '30's the house of Captain Francis B. Watlington was the only structure on Duval Street after crossing Caroline. Some fine old houses had been built of lumber floated over from the Bahamas. These stood on the low ridge of coral rock.

At times, when wrecks thrust large groups of salvaged passengers or crews upon the hospitality of the city, tents would be erected—as many as 50 or 60 of them. Many of the refugees were taken into private homes and, according to their mood, excitement often resulted. Rioting was not infrequent, and on occasion marines from the "Vincennes" or some other United States vessel were called in to quell the disturbance.

To all this, Audubon paid scant attention. His passionate interest was in the birds and plants of the island. He never tired of familiarizing himself with the rich natural life that abounded. Stephanotis vines hung everywhere; flaming poinsettias, hibiscus, allamanda, and great ropes of crimson and violet bougainvillea bloomed on every hand; and everywhere the birds! He rose each day at three o'clock in the morning, and from then until noon, and sometimes until night prevented further observation, he hunted among the mangrove hammocks for his specimens. Not heat, sand flies, or mosquitoes interrupted his arduous schedule. Returning from these expeditions, he set about making sketches of his finds, drawing hundreds of plants and birds, and writing copious notes for future reference.

His industry amazed the islanders. In an old copy of the *Gazette*, the editor reports wonderingly and with admiration, "Mr. Audubon is a most extraordinary man, possessed of an ardent and enthusiastic mind and entirely devoted to his pursuits; danger cannot daunt, and difficulties vanish before him . . ." The good editor went on to say, "Mr. Audubon has adopted a most excellent plan of connecting with his drawings of birds such plants as may be found in the neighborhood where they are taken. We hesitate not in giving it as our opinion that his work on ornithology, when completed, will be the most splendid production of its kind ever published, and we trust that it will be duly estimated and patronized."

Audubon was much liked in Key West. "The private character of Mr. Audubon," the newssheet continued, "corresponds with the nature of his mind and pursuits—he is frank and generous, always willing to impart information, and to render himself agreeable. The favorable impression which he has produced upon our minds will not soon be effaced!"

It was in Key West that Audubon painted his famed white-crowned pigeon. Some historians have erroneously recorded that he was the first ornithologist to find this beautiful bird in the United States. Actually the species was already known. It had been found in 1824 by Titian R. Peale, an artist and naturalist employed by Charles Lucien Bonaparte. Audubon had, it is true, used a local specimen for his model, but it was a migrant from Cuba or some other part of the West Indies. The snowy-topped purple pigeon still nests in the Keys and on the tip of the mainland in spring and summer.

When Audubon finally made his way north again, he carried love of the Florida Keys in a grateful heart. His notebook was filled with his observations. He had made many friends. He had enriched his great work. The interlude came to be a golden memory in a memorable life.

FIELD TRIP TO THE SOUTH SEAS

Continued from page 15

ity and warmth. Like the chiefs on Fais, he was heavily tattooed and wore a simple comb in his hair but no other decorations.

We stayed at Ulithi four more days, and in addition to Mog Mog we visited the islands of Asor and Fassari. King Ueg came along with us, and on each island he commanded the best fishermen to give me all the help I needed. Rows of rusty quonset huts—a fabulous leftover from the days of World War II when the Navy maintained a large base at this atoll—lay rotting among the coconut trees. Asor particularly had many of these eyesores unsuitable to a tropical island.

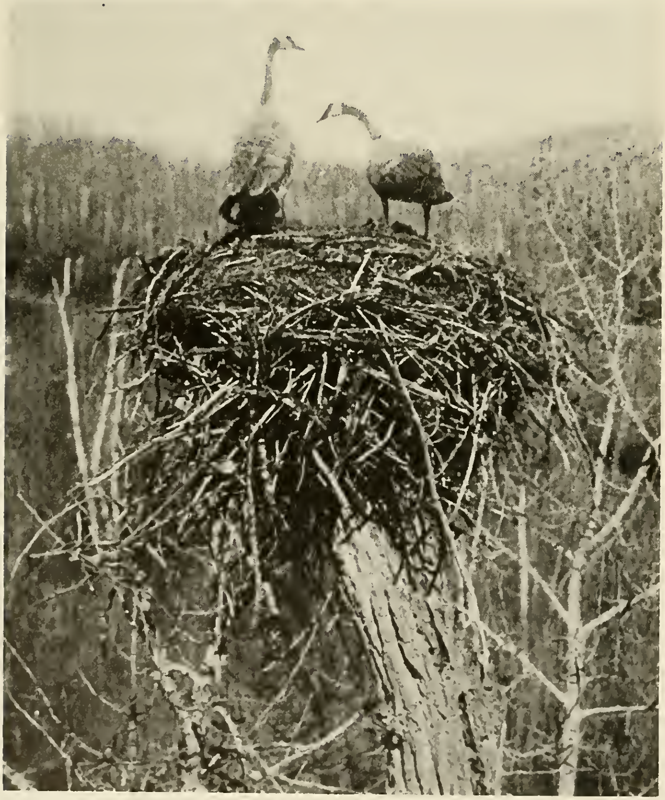
Fortunately, the important parts of my days were spent as usual in the least battle-scarred and most beautiful part of the South Seas—in the forest of corals and algae, where the graceful plumed heads of annelids and sea anemones three feet in diameter are the flowers, and fishes and fishermen are birds flying in three dimensions.

Ulithi was the last place for my underwater explorations. From there it was straight back to Koror where, after a few days of packing all my specimens I started the long plane ride back to New York.

Now that the fishing trips are over (at least for the present), and the many desired specimens have been obtained, much work still remains to be done. The expedition has, of course, provided material for many months of extensive laboratory work.

In my laboratory at the American Museum there are now hundreds of jars of what some persons might consider rather dull-looking preserved fish. But when, for example, I examine a faded specimen labelled "*Paraluteres prionurus*, reef on NW side of Kayangel, September 4, 1949," I can recall a little fish of brilliant colors, darting among large mushroom-shaped corals, and I remember the long chase after this evasive filefish, the excited feeling when my spear finally made its mark—the capture of a souvenir from an enchanting island 9000 miles away.

LETTERS



Treetop Nesters

SIRS:

In your November issue you published a letter from Mrs. Sunnie F. Lancaster of Opportunity, Washington, on the subject of geese nesting in trees. With the letter were printed some comments from my good friend Dr. John T. Zimmer. His remarks left no doubt that geese do occasionally depart from the habits laid down in the "bird books." As further evidence, I offer the accompanying photograph from the files of the Fish and Wildlife Service. It shows a pair of Canada Geese nesting in a fairly tall tree.

This picture was taken several years ago by Mr. Guy Thomas, who, I understand, was a guide in British Columbia. He sent it to the late Dr. E. W. Nelson, then Chief of the Bureau of Biological Survey. As I recall, the accompanying letter stated that the nest pre-empted by the geese had been orginally built either by ospreys or bald eagles.

F. C. LINCOLN
Assistant to the Director
Fish and Wildlife Service,
Washington, D. C.

NOTICE—Readers are encouraged to submit their own photographs of natural history subjects. Those selected for publication on these pages will be paid for at $3.00 each, with full credit to the photographer. Return postage must be included.

Tale about the Tails

Sirs:

In a recent popular book on animal intelligence, the author states that the mother opossum (*Didelphis virginiana*) arches her tail over her back and that the young ride around holding onto it with their own tails. I have examined several books on North American mammals but cannot find any author who substantiates this belief. I have a faint recollection that one author mentions this as a myth perpetuated by some taxidermist who mounted a female opossum with a number of young ones suspended from her tail.

I will be much interested to learn if there is any truth in this belief . . .

George W. Rawson, D. V. M.
Summit, N. J.

The following information is offered by Mr. T. Donald Carter of the American Museum's Department of Mammalogy:

There are numerous drawings and references concerning the habit of young opossums of entwining their tails around the tail of the mother for the purpose of more ably securing themselves on her back as she travels about. Undoubtedly the best-known statement of this sort and the one that is most frequently quoted is found in *The Quadrupeds of North America* by John James Audubon and the Rev. John Bachman (1851, vol. 2, p. 123). Dr. Bachman writes: "When the young are four weeks old, they begin from time to time to relax their hold on the teats, and may now be seen with their head occasionally out of the pouch. A week later, and they venture to steal occasionally from their snug retreat in the pouch, and are often seen on the mother's back securing themselves by entwining their tails around hers. In this situation she moves from place to place in search of food . . ."

There is some controversy as to just how often young opossums will wrap their tails about their mother's. That they do it occasionally, I do not doubt, for I have also seen them encircle her nose and her limbs with their tails as they desperately hang onto her fur with their feet. But from personal experience I have never seen a family of live opossums, as is sometimes pictured, with the tail of the mother carried over her back and with the young ones, in an inverted position, hanging over the mother's sides with their tails about hers. I rather doubt that this ever occurs. The young prefer to ride in a more normal upright position, with their heads over their mother's back, clinging to the hair on her sides; or if there is room, they may be well up on her back or over her neck. An opossum, especially when climbing about among the branches, is constantly using its tail as a balance and would be greatly hindered by having a family attached to it.

A person fortunate enough to take a photograph of a family of opossums with their tails attached to the mother's would do us a great service by sending it in, for such a picture should be published.

Milk when Milked

Sirs:

My friends and I were talking about domestic animals the other night, and during our discussion an interesting question arose that none of us could answer. Could you perhaps give us the answer?

Does a cow give milk all the time or only after she has calved? And what happens if she has calved once and no more? (We know that she gives no milk during her pregnancy.)

Gary Brauner
Bronx, N. Y.

The following remarks are offered by Dr. Lester R. Aronson of the American Museum's Department of Animal Behavior:

Young virgin cows (heifers) do not give milk. Lactation (the secretion of milk) starts immediately after the end of pregnancy when the young are born. The secretion of milk will then continue as long as the cow nurses or is artificially milked. However, there is a gradual decline in the amount of milk produced, so that farmers generally remate their cows before the milk production gets too low or ceases altogether. If nursing or milking is discontinued, then lactation will cease in a day or two.

These facts have been well known to farmers and animal husbandry men for centuries, but it is only within the last two decades that scientists have gained an understanding of the mechanisms involved in the production of milk. Except for minor variations, this mechanism appears to be the same for all mammals. Scientists have found that milk production is controlled basically by hormones. These are complex chemicals which are secreted directly into the blood stream of the individual by certain glands known as endocrine glands. Typical examples of endocrine glands are the pituitary, ovary or testis, thyroid, adrenal, etc.

There are four major aspects to the production of milk. The first is the growth and development of the mammary glands. This is largely controlled by a hormone known as estrogen, which is secreted primarily by the ovary. Following puberty when the ovaries become active, estrogen is secreted and the mammary glands begin to develop. The amount of this development varies considerably among the mammalian species. After pregnancy has started, ovarian activity increases greatly, much more estrogen is produced, and the mammary glands enlarge and develop at a faster pace. This mammary development is aided in most species by a second hormone known as progesterone, which is secreted in part by the ovary and in part by the placenta (the afterbirth).

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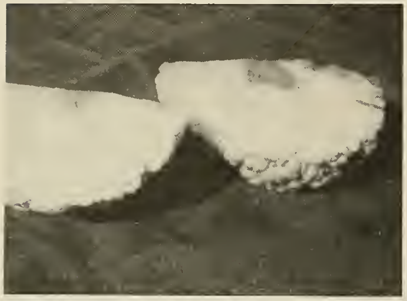
While pregnancy is in progress, a third hormone, lactogen (or prolactin), is accumulating in the pituitary gland, a small organ situated at the base of the brain. At the termination of pregnancy, the pituitary gland becomes highly activated and begins to secrete large amounts of lactogen. This lactogen initiates the second aspect of milk production, namely, the secretory activity in the mammary glands, or what is called lactation. Several factors seem to be involved in this sudden initiation of activity in the pituitary gland at the end of pregnancy. These are: (1) certain marked and rapid changes that occur in the ovary at this time, (2) the loss of the afterbirth and its secretory activity, (3) relaxation and collapse of the uterus, (4) a marked decrease in the amount of estrogen produced by the ovary, (5) the stimulus of nursing or milking. The importance of the last factor is demonstrated by the well-known fact that cows and certain other mammals can sometimes be brought into full lactation before parturition by the stimulus of milking.

The third aspect of milk production is the maintenance of lactation during the period of nursing and often far beyond. The major factor here appears to be the repetitive and regular stimulation of nursing or milking. This stimulation appears to work through the nervous system, which causes the pituitary gland to continue to secrete lactogenic hormone. In humans the so-called "wet nurses" who, in the days before artificial formulae were instrumental in saving the lives of so many infants, maintained their milk supply far beyond the normal nursing period by always having at least one infant at the breast. An older belief that the pressure caused by the actual accumulation of milk in the mammary glands caused the cessation of lactation has been questioned recently and appears not to be true, at least for some mammals.

The fourth aspect of milk production is the actual delivery or "letting down" of milk. This process is also controlled by the stimulus of milking or suckling, but psychological factors such as the sight of the young, the time of the day, or the sound of the farmer or milking machinery may be equally effective.

▲ THE FRUIT: a lumpy green globule



▲ INSIDE, the "orange" is fleshy and milky

Osage Orange

By DOROTHY D. FREAS

It looks like a fruit tree but acts like a fence

HAVE you found a *bois d'arc* "orange" in the park and looked around to find the tree from which it might have fallen? It is the fruit of the Osage orange tree—a green globule, fleshy and milky inside.

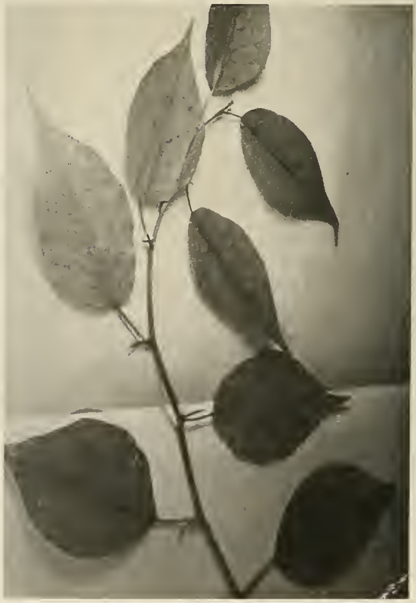
The branches of the tree are an orange-brown shade, although the trunk may be a rich brown. It grows 40 to 60 feet high, but the lowest branches are not far above the ground.

In the early days of colonization, farms in America were fenced in from the forest with a row of young Osage orange trees. It was too costly to put up a wooden fence, and these trees needed no repairs as they grew. In fact, they grew easily in the warmer sections of the Midwest. A cutting from an older tree would soon be a thriving new one. The Osage orange tree was pest-resistant and, having some thorns, it made a good protective fence in the days before barbed wire.

The Osage orange is not edible. The tree is a member of the Mulberry family and is technically known as *Machura pomifera.*

◀ THE OSAGE ORANGE grows 40 to 60 feet high

▼ ITS THORNS make it a good fence



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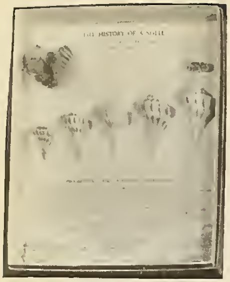

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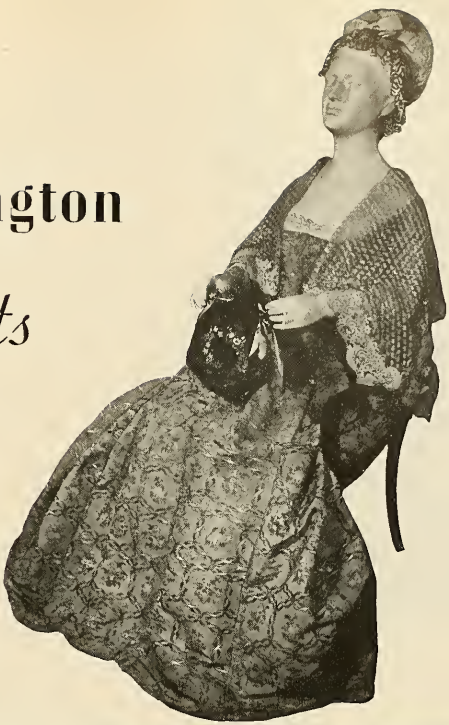
Martha Washington *Wore Insects*

By Frank A. Woodfield



↗ **Dress** worn by our country's First Lady. It is made of salmon-pink taffeta decorated with hand-painted insects and wildflowers

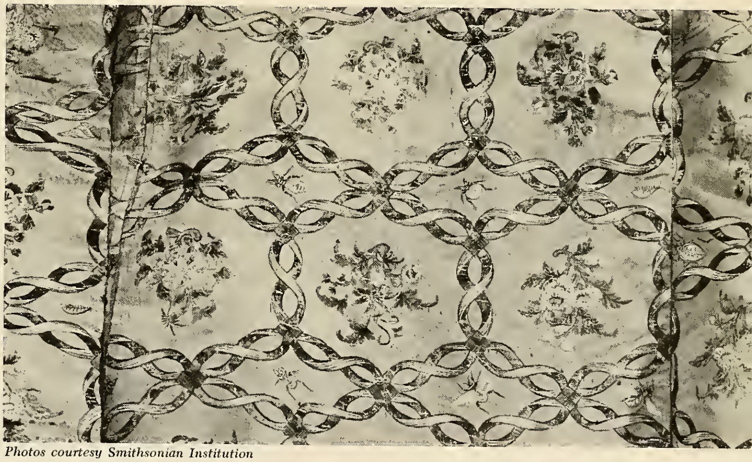
MEN who are following the current vogue of wearing neckties decorated with butterflies, birds, rabbits, or other creatures of the wild may imagine that they are setting a precedent in fashions. Actually, the present mode can be traced back to the origins of our country and, indeed, far into the dim recesses of history. Insects were worn for adornment in ancient Egypt and earlier. It is a surprise to many, however, that our nation's first First Lady wore a dress decorated with insects. Moths, flies, wasps, bees, grasshoppers, spiders, ladybugs, and snails filled the spaces not otherwise taken up by a design of twining ribbons and flower clusters, including arbutus, buttercups, violets, morning glories, and daisies.

The dress is hand-painted and is believed to have been obtained for Mrs. Washington in England following the Revolution. But to the casual observer, the tiny creatures seem to be types common to this country. Unfortunately, the figures are so generalized that it is not possible to determine whether they were copied from specimens native to Europe.

Was Mrs. Washington a naturalist in the ordinary sense of the word? There are ample indications that she loved her garden, her flowers, her herbs, etc. But did her interests carry her so deeply into the field of nature that she was really fond of beetles, spiders, and snails, as well as the beautiful butterflies that undoubtedly added color to the Mount Vernon landscape? The question may have to go unanswered; but her gown, now one of the collection of dresses of mistresses of the White House, gives silent evidence to visitors to the National Museum in Washington that she was not too squeamish to wear likenesses of "crawly" things.

Whether her husband had such adornment is rather doubtful, although there is abundant evidence that men's waistcoats and jackets of that time were in some instances lavishly decorated with flowers and leaves.

▼ **Detail** of the material in the dress above, showing the hand-painted insects with which Martha Washington was willing to identify herself



Photos courtesy Smithsonian Institution

LETTERS

Kon Tiki *and Pacific Migration*

Sirs:

Having read *Kon Tiki* by Thor Heyerdahl with great interest, I was happy to find the review of it in your December issue.

Gordon F. Ekholm and Junius B. Bird appear to believe that there is weightier evidence that "the peopling of the Oceanic islands resulted from movements outward from Asia."

I am very curious now to know what this school of thought has to offer in evidence for their hypothesis. The story *Kon Tiki* has taken hold of the imagination of a lot of people who have never previously concerned themselves very much with ethnological theories. And if *Kon Tiki* leaves the reader with misconceptions based on the "misstatements, half truths, and poorly reasoned anthropological speculations," the truth should be brought to light. On the other hand, if these critics are unfair in their estimate of Mr. Heyerdahl's logical conclusions, he should be supported . . .

May Orrell

Cardinal, Virginia.

The following comments are offered by Dr. Alphonse Riesenfeld, Research Assistant in the American Museum's Department of Anthropology, who is the author of a recent authoritative book on megalithic remains in Melanesia:

The Polynesian languages, in grammar and vocabulary, are related to the Melanesian, Micronesian, and Malayan languages, and their relationships extend as far distant as India, with an offshoot even to Madagascar. On the other hand, only a few isolated word similarities are recognized between the Polynesian and a few American languages, the validity of which is doubted for various linguistic reasons. In other words, we have a linguistic bridge connecting Polynesia with southeastern Asia but not with America, a fact inconceivable had the Polynesians come from America.

Two of the most typical Polynesian stone axes are those of quadrangular cross section and the kind that are known as stepped axes. They are widely distributed in many of the Pacific islands and are known as far as southeastern Asia. At the famous site of Yang Shao in southern China, the strata containing quadrangular stone axes have been dated at approximately 2000 B.C., and stepped axes of the Philippine sites cover the period 1250-200 B.C. Since Heyerdahl accepts A.D. 500 as the earliest date for the settlement of the Polynesian islands, the Polynesian stone axes can only have come to Polynesia from the west, where they are so much older and not vice versa.

Heyerdahl considers the personage Kon Tiki to be the founder of Tiahuanaco, a site very rich in pottery remains. If so, Kon Tiki must have been familiar with pottery. If he migrated directly from Peru to Polynesia, how is it possible that no pottery is found in Polynesia? The raw material has been available. The eastern Polynesian islands (Easter Island, Marquesas, Mangareva, etc.) are volcanic in character and produce clay as a disintegration product. On the other hand, Polynesians coming out of Asia had to cross many coral islands, where no clay is available and where therefore the art of pottery-making might have been lost.

As one of the reasons for his theory of an American origin for the neolithic or "new-stone age" Polynesians, Heyerdahl indicates that "there were no cultures in the world of any reproductive capacity which were still at the Stone Age level in A.D. 500 or 1100 except in the New World." This statement is incorrect on all points. First, at Tiahuanaco—the site associated with Kon Tiki—metal was so abundant that the people could afford to use copper tie-bolts to join large stone blocks. This pre-Inca culture was therefore no longer in a pure stone age. Second, from archaeological and ethnographic observations it has been proved that long after the introduction of bronze and iron, the use and fabrication of stone tools persisted in southeastern Asia, Indonesia, and as far as western New Guinea, in some places as recently as the twentieth century. Third, the fact that the Polynesians do not possess metals does not necessarily mean that their culture was derived from one lacking metals. In fact, the stepped stone axes of the Philippines (prototype of the Polynesian stepped axes) in the strata dated 1250 B.C. and later, are mixed with bronze objects. This leads to the conclusion that the Polynesians originally used metals but lost the art of metallurgy through lack of proper materials on coral atolls and most of the other Pacific islands. Indeed, many of the decorative elements in Oceanian art can be traced back to decorative elements of bronze objects.

The megalithic monuments of the Pacific islands are closely related to those of southeastern Asia in form and function. The people who introduced these monuments, according to the traditions, were light-skinned Malayo-Polynesian migrants. Now, in those areas where their migrations have been studied, as, for example, in Melanesia, they follow a continuous west-to-east course incompatible with an American origin. According to the traditions, the introduction of the coconut and the pig is attributed to these immigrants. This means that both these elements must have come to the islands from the west, if the traditions are correct. In fact, the coconut, which is very important in all the Pacific islands, was originally unknown on Easter Island and Rapa and rare in the Marquesas. It is absent in all Peruvian archaeological sites and is probably of post-Spanish introduction in the West Indies. Equally, the pig, which is considered by zoologists as of Indo-Malayan origin and which is known all over the Pacific islands, was originally unknown on Easter Island, Rapa, Tuamotu, and New Zealand as well as in America, where it is of post-Spanish introduction. If the Polynesians had come from America, the domestication of the pig and the use of coconuts should not be absent in aboriginal America and eastern Polynesia. The words for pig and coconut over wide areas of the Pacific are clearly Malayo-Polynesian. Also it is to be noted that both elements are lacking in aboriginal Australia, which has not been touched by Malayo-Polynesian migrations.

The theory of an American origin for the Polynesians is further contradicted by the current Polynesian tradition that their original homeland, Hawaiki, lies in the west. This tradition is corroborated by the belief that the spirits of the dead go to the afterworld in the west, thus retracing the migration route of their ancestors, as is the case in so many other native societies. The only Polynesian tradition speaking of immigrants coming from the east is that known on Easter Island, and there is not even unanimity

Continued on page 96

NATURAL HISTORY

The Magazine of the American Museum of Natural History

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FEBRUARY, 1951

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You will find Natural History *Magazine indexed in* Readers' Guide to Periodical Literature *in your library*

THE COVER THIS MONTH

The Gila Woodpecker is one of the interesting inhabitants of the arid Southwest. It is a noisy and not unduly shy bird and is therefore easily observed.

It excavates its nesting hole in the stems of the stately giant cactus—a cavity extending about a foot downward from the horizontal entrance. The juice from the broken plant tissues gradually hardens around the excavation and in time forms a firm, shell-like lining. After the pulp of the plant has rotted away, this gourd-shaped lining may remain intact among the skeletonized fibers.

It has been reported that the time it takes for the sap to harden requires the birds to excavate a nesting hollow a year in advance. At any rate, new nests are not constructed every year, perhaps not until an old one is destroyed or, as may often be the case, pre-empted by some other desert dweller like the Elf Owl.

Nests are also constructed in cottonwoods and other trees, but they then resemble the nests of other members of the woodpecker family. The eggs are three to five in number and are plain white—a feature noted among many, though not all, birds that nest in holes.

—John T. Zimmer.

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OUT OF THIS WORLD

- - - - - - - - by Lowell Thomas, Jr.

The Greystone Press, $3.75
320 pp.

TO Occidentals, the name Tibet has always been synonymous with mystery, romance, and high adventure. No other region in the world is so little known, because getting into Tibet with official permission was almost as difficult as for the proverbial rich man to enter the Kingdom of Heaven. Up to the time Lowell Thomas, Jr. and his famous father crossed the roof of the world to Lhasa, only six other Americans had been admitted to the country.

The Thomases' visit came at the most critical period in the history of the Hermit Kingdom, for a few months after their departure, Communist hordes from China were on the march toward the sanctuary of the Dalai Lama. Therefore, Lowell, Jr.'s book is particularly timely. It is somewhat as if Marco Polo, returning from his "travels," had found publication of his book about them coincident with a war threat from Kublai Khan.

Never has a journey into a mystery land been so closely followed by so many people in so many countries of the world. Through the miracle of radio recording, the day by day account of the traveler's progress across the bleak Tibetan steppes was brought into every American home.

Now, a complete story of the journey has been given in *Out of This World.* The book is as unpretentious, as American, as young Lowell himself. He does not pose as an authority on Tibet, but he gives an enlightening background of the country, drawn from the accounts of earlier explorers. He tells of the vicissitudes of the journey; of what they did and how they did it; of the people and their customs; of an interview with the Dalai Lama and ceremonies in the mysterious gold-roofed temples; of the Tibetan nobility and the common folk. The book concerns a strange people still living happily in Oriental seclusion; a people who are about to die, as a nation, at the hands of Red assassins.

The Thomases saw Tibet with the Dalai Lama as the God Incarnate of the Lamaistic world. They were fortunate, and we are nonetheless fortunate that an enthusiastic American youth, with an educated but impressionable mind, should have written so compellingly of the last days of Tibet. I find it fascinating reading. It will remain in my library as a valuable historical document—a record of what was but will never be again.

ROY CHAPMAN ANDREWS

THE BEN LILLY LEGEND

- - - - - - - - - - by J. Frank Dobie

Little, Brown and Co., $3.50
237 pp.

THIS book is well named, for a full account of Ben Lilly has to deal with much that must be characterized as legend. Like Paul Bunyan, but to a lesser degree, Ben Lilly is credited with tall achievement. Within his field of special training he was exceptionally competent, and many of the surprising stories told of him are well attested. Dobie, with the thorough preparation which is a hallmark of any book he writes, gives the reader a great mass of biographical data and the trimmings based on it by hearsay.

Ben Lilly, 1856-1936, has the reputation of a great bear hunter. Killing bears seems to have been an obsession with him, and conservationists who read this book will be thankful that he was unique. When one gives due consideration to the element of courage and endurance that Lilly brought in full measure against bears wherever encountered, the balance of his activity is a merciless campaign of extermination. Because he typifies the hardy pioneer who saw nothing remiss in taking a ruthless toll of nature, one can learn from his biography something of the psychology of such an individual.

He was a man of strong convictions, which conformed in some respects with the better aspects of human nature but in others brought out less admirable traits. He would not work on Sunday and carried this determination to extreme lengths. He was fearless and fought bears under conditions that no normal hunter would dare accept. He was indefatigable, traveling day and night and going without food over long periods. He was tougher than the bears and mountain lions he hunted. He was a keen observer and knew the habits of wild animals. And in some of his personal habits he seemed to have had much in common with the wild animals.

I think the average reader will have mixed emotions after reading this book. He will have great respect for the rugged qualities of the Lilly character; he will marvel at the one-track mind that drove Lilly roughshod over time and convention; but he will deplore the fact that all of this force and determination was directed toward killing.

HAROLD E. ANTHONY

BEES:

Their Vision, Chemical Senses and Language

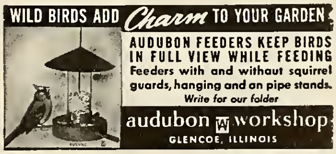
- - - - - - - - - - by Karl von Frisch

Cornell University Press, $3.00
119 pp., 61 illusts.

THIS admirable little volume should commend itself to a host of readers and for a variety of reasons. In this generation—and one might well extend the statement to include the generations of the past—there is no one who has delved more persistently or more ingeniously and adroitly into the capacities of the honeybee than the distinguished melittologist, Professor Karl von Frisch. The facts he has painstakingly established after about 40 years of devoted investigation are among the most startling yet revealed regarding an insect that has offered many surprises.

Those who attended the three lectures Professor von Frisch delivered before the American Museum in the spring of 1949 as well as those who heard him give some or all of these lectures in other parts of the country will no doubt welcome the opportunity to retrace, through the printed word and with photographic supplementation and diagram, the curious discoveries which he imparted in his entertaining talks. Those who missed these lectures owing to distance or inaccessibility now have the chance to retrieve a missed opportunity.

In addition to these general audiences for which the book has appeal there are the special groups of readers to whom it is a prime necessity. The students of animal behavior will find it indispensable, and entomologists, even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those interested in orders other than the Hymenoptera, can ill afford to neglect its contents. While primarily concerned with research undertaken for its scientific interest alone, the book has its practical aspects that concern the agriculturist and the apiarist. Some of the techniques may be applied with advantage to assure the more adequate pollination of a desirable plant, to obtain a higher yield of honey, or for other objectives of personal interest or of benefit to the community as a whole.

As the subtitle indicates, the book is devoted to the vision, chemical senses, and language of the bees—one hastens to add (perhaps a little unnecessarily) that the "language" is not communication by sounds but information imparted by body motions and flower-derived scents, or even self-secreted scents. An appendix adds certain vital experiments and observations made since the lectures were delivered in this country, and an ample bibliography offers guidance to those who wish to delve more fully into the pertinent literature.

HERBERT F. SCHWARZ

GREAT AMERICAN NATURE WRITING

Selected and with Commentary by Joseph Wood Krutch

William Sloane Assoc., $5.00, 444 pp.

EVERY anthologist is confronted with the problem of selection. On the whole, Mr. Krutch's selections are good examples of outstanding American nature writing. However, since the title of this anthology indicates that these selections are samples of "great" American nature writing, the anthologist has placed an extra burden upon himself, that of passing judgment as to the relative quality of the efforts of the authors included in the anthology. Writers such as Thoreau, Muir, and Burroughs have been established in the minds of many as leaders in their field of writing. The recent writers whose works are included are well known, but one hesitates at this time to confer upon them the mantle of greatness. Devoe, Beebe, and Peattie are outstanding, but time will tell whether or not their works are to have a lasting significance. Some of the writers included are far better known for their activity as explorers, naturalists, and scientists than for their extraordinary literary ability, such as Vilhjalmur Stefansson, Richard E. Byrd, and William Morton Wheeler.

Samuel L. Clemens is in a class by himself, and his work has its established place in the general field of American literature. His "Roughing It" may be a significant example of American nature writing, but Clemens will be remembered for his other works.

The pieces selected, which are not necessarily the better-known works of the authors, should have wide appeal. For example, the short but powerful editorial type of essay by Alan Devoe on the sad fate that befell a sea cow in "The Brave Men of Brielle" shows a feeling for nature as intense as that displayed by Richard E. Byrd in the excerpt from his book *Alone.*

I missed a few select items such as Lafcadio Hearn's "The Storm" and Rockwell Kent's *Wilderness,* but no anthology can completely satisfy everyone. Harry Beston's "The Headlong Wave" has as much a feeling of the sea as Hearn's "The Storm," and Byrd's *Alone* is perhaps more moving than Kent's *Wilderness.*

Krutch's attempt to show that American nature writing is "an emergent literary form struggling for its own independence" is in my opinion too lengthy. An anthologist has the privilege of commenting on his selections, but a hundred pages or so of essay and comment may disturb some readers who are more interested in the selections in the anthology than in the anthologist's own writing.

Rudolf Freund's delightful decorations embellish this unusual and ambitious effort of anthologist Krutch.

JOHN R. SAUNDERS

THE SCULPTURE OF NEGRO AFRICA

- - - - - - - - - by Paul S. Wingert

Columbia University Press, $4.50
96 pp., 118 plates,
numerous line drawings

SINCE the early part of this century, African Negro sculpture has exerted a marked influence on the art of Western Europe, and the impact of this tradition is reflected in the works of such painters and sculptors as Picasso, Derain, Vlaminck, and Laurens. Native African sculpture has long been appreciated in art circles, and several leading museums in this country and abroad have featured it in major exhibitions, yet there have been surprisingly few attempts to characterize the several regional and tribal styles that compose this great tradition, or to make them known to the general public. In the present handsome and important book, Dr. Wingert undertakes both objectives.

The author classifies African Negro sculpture in accordance with four main geographical regions: West Africa, Cameroon, Central Africa, and East Africa. Within each of these areas he further defines and characterizes a number of tribal styles. These descriptions are greatly enhanced by a profusion of pen-and-ink vignettes placed conveniently in the margins, as well as by the numerous and excellent plates. The specimens illustrated have been drawn exclusively from American collections, and typical examples rather than exceptional pieces have in most cases been selected.

Generally speaking, there are two principal approaches to primitive art. The art critic judges an object aesthetically and in terms of its artistic qualities. The anthropologist, on the other hand, treats it as an element of culture and appraises it with reference to its ethnological significance. In his approach to African Negro sculpture, Dr. Wingert falls somewhere between these opposing trends. Unlike earlier critics who dealt exclusively with the aesthetic features, he carefully sketches the cultural background and discusses the purposes the carvings were made to serve. Yet, in spite of the attention paid to cultural context, the sculptures are illustrated as "Art" rather than as ethnological specimens. Similarly, although Dr. Wingert's approach to the material is in the best anthropological tradition, the tribal styles are to a large extent described in the special terminology of the fine arts world, a jargon often obscure to the uninitiated.

In order that the accuracy of the stylistic characterizations may be evaluated, it should be borne in mind that for very few of the many objects illustrated is the precise tribal origin given. To the artist such omissions will make little difference, but they are bound to disturb the anthropologist. This volume is, nevertheless, the most scholarly and comprehensive treatment of the subject to date, and it fills an important need both as a text and as a reference book.

Harry Tschopik, Jr.

THE STORY OF MOUNTAINS

- - - - - - - by Ferdinand C. Lane

Doubleday and Co., $6.50
488 pp., 32 illusts.

THIS king-sized book tells all about mountains, how they are formed, where they are located, and what special circumstances qualify them for particular comment.

A mountain is a breath-taking object whether one gapes at it from the foot or gasps from the summit. Some mountains are, beyond question, the most awe-inspiring spectacles on earth. Primitive peoples were stirred by towering mountains, as is evidenced by the names they gave them. Courses of empire have been dictated by the location of mountains.

Dr. Lane writes his story in simple readable terms, documenting it by frequent references and highlighting it by glorious half-tone illustrations. The plates alone are worth the price of the book. The treatment is by a series of short chapters, one hundred fourteen of them, which begin as introductory material, pass through a great panorama of special relationships, i.e., mountains in history, mountains in geography, mountain biology, etc., and conclude with a broad outline of mountains as distributed on a continental basis.

There are many anecdotes of mountain climbing, hairbreadth escapes, and dire tragedy. Technological advance makes it possible for man to fly about the top of Everest, but to climb the mountain he still must rely upon the equipment nature gave him—stout legs and heart and sound lungs. Unless he has these, all the gadgets that make him comfortable afoot or in camp are of little avail. But modern man is a better mountain climber than his primitive ancestor. Mountain climbing is a science today which takes full advantage of cordage, metal, and weather reports. The number of unclimbed peaks is dwindling. But human nature is such that as long as one exists, it will be a constant challenge to the hardy few who long to set foot on it. Most people, however, will find it far more attractive to do their mountain climbing vicariously from the pages of this book.

Harold E. Anthony

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Weldon F. Heald photo

▲ THE HUACHUCA MOUNTAINS straddle the Mexican border and provide a "vertical oasis" in the arid grasslands of the San Pedro Valley. Students are only beginning to realize the diversity of climate and life in this paradise

▼ FLASHLIGHT PHOTOGRAPHY appeals to the outdoorsman equipped to stay overnight in this mysterious world of forest and crag

C. F. Stoody photo from Western Ways

Sky Islands o

By

WELDON F. HEALD

TO most of us, islands are fascinating places. They stir our imaginations with their complete, self-contained independence, isolated from the rest of the world by wide stretches of water. However, some of the earth's most interesting "islands" are nowhere near oceans or lakes. They are strictly land islands but with a climate, vegetation, and animal life as different from their surroundings as if they rose from some remote sea.

Such a group of land islands are the dozen or so mountain ranges in

Lark photo from Western W

▲ A PANTHER, sharp of tooth and claw but as much a part of the wilderness as the animals on which it preys

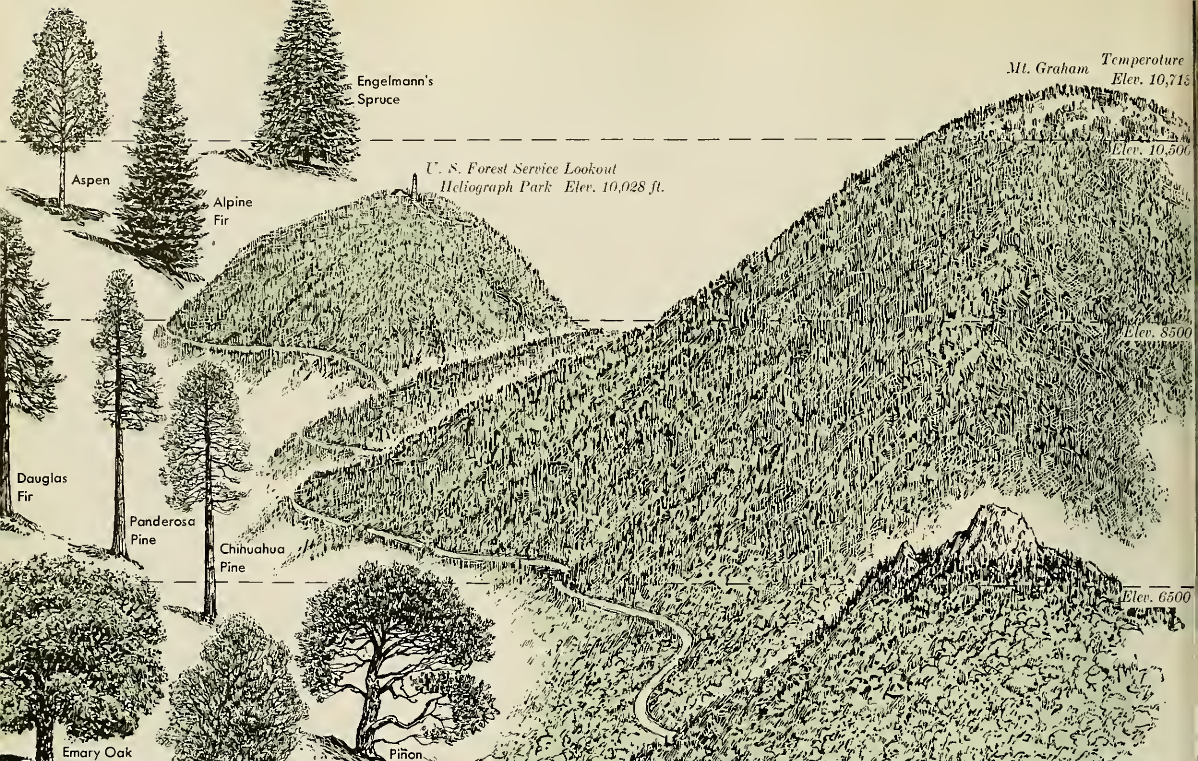
ARIZONA

From a searing desert near the Mexican border to the bleak subarctic in three hours and a half. Roam these mysterious isles in the clouds, and you will become almost every kind of an explorer at once

Arizona's southeastern corner. They show all the characteristics of real islands, except that they are separated from one another by dry land. Twenty to forty miles long and arching into the blue Southwestern sky to heights of 7500 feet to nearly 11,000 feet, these great isolated ranges stretch north and south across a semiarid, wide-sweeping highland country the size of West Virginia.

Out of a sea of desert and rolling grasslands, southeastern Arizona's mountain-islands thrust their summits into a climate comparable to that of Labrador and carry upon their broad backs a cluster of cool northern evergreen forests 600 square miles in extent. Up in these surprising, high-perched oases, just north of the Mexican line, are shaded roads and trails through pine, fir, spruce, and aspen woods. There are wildflower meadows, too, lush fern brakes, tumbling streams, and hushed camp sites where you can hear the twilight song of the hermit thrush. Nowhere on the continent is the cooling effect of altitude more strikingly demonstrated, nor is there a more abrupt meeting of cactus-spiked desert with luxuriant temperate forests.

These ranges show similar family characteristics, but each has a personality distinct from its neighbors. In this way they resemble individual islands of a group, such as those of the Azores or Hawaii. Like islands, too, each range has developed unique varieties and even species of plants, animals, and birds unlike those found anywhere else. Thus the Chiricahua Mountains are


Engelmann's Spruce
Mt. Graham
Temperature
Elev. 10,71
Elev. 10,50
Aspen
Alpine Fir
U. S. Forest Service Lookout
Heliograph Park Elev. 10,028 ft.
Elev. 8500
Douglas Fir
Panderosa Pine
Chihuahua Pine
Elev. 6500
Emary Oak
Piñon
Alligatar Juniper
Elev. 4500
Creosote Bush
Cholla
Ocotillo
Yucca
Prickly Pear
Borrel Cactus
Swift Trail
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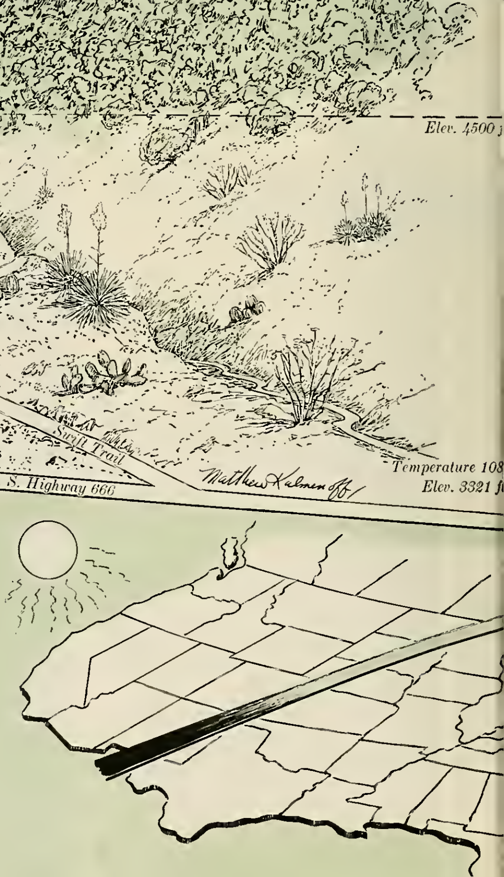
Matthew Kalmenoff
Temperature 108
Elev. 3321

THE MOUNT GRAHAM CLIMATE LADDER

ON this Arizona "Sky Island" you can drive your car in one hour from the desert to pine and fir forests with a climate like that of northern Minnesota. A four-mile hike then takes you to the summit, where the climate is comparable to Canada's Hudson Bay. In less than half a day, the climatic ladder has taken you through all the zones you would meet in traveling 2200 miles north. Climate so profoundly affects plant life that botanists have long been accustomed to dividing the slopes of mountains into vegetational zones roughly like the ones that are determined by latitude.

A drop of 1 degree F. for every 100 feet in altitude is frequently taken as the average. But the variation from this is great, especially in summer. The day that the author made this ascent, the drop averaged 1 degree for every 132 feet—from 108 degrees at 3321 feet to 52 degrees at 10,713 feet. This is not unusual for the summer rainy season in southern Arizona.



HUDSONIAN ZONE

Climate: central Labrador
Precipitation: 40 in. yearly
Vegetation: Engelmann's Spruce, Aspen, Alpine Fir

CANADIAN ZONE

Climate: summer, northern Maine
winter, Connecticut
Precipitation: 30 to 40 in. yearly
Vegetation: Ponderosa Pine, Mexican White Pine, White and Douglas Fir, Aspen, Birch, Maple, Dogwood

TRANSITION ZONE

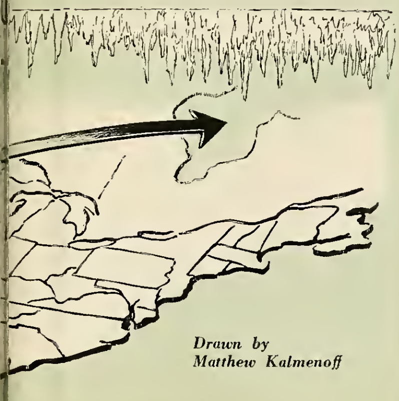
Climate: summer, central Minnesota
winter, Tennessee
Precipitation: 20 to 30 in. yearly
Vegetation: Chihuahua Pine, Ponderosa Pine, Mexican White Pine, White Fir, Douglas Fir, Utah White Oak, Silverleaf Oak, Netleaf Oak, Maple, Alder

UPPER SONORAN ZONE

Climate: summer, New Jersey
winter, Mississippi
Rainfall: 10 to 20 in. yearly
Vegetation: Emory and Arizona White Oak, Alligator Juniper, some Piñon. Chihuahua Pine in higher levels

LOWER SONORAN ZONE

Climate: northern Mexico
Rainfall: 8 to 10 in. yearly
Vegetation: Prickly Pear, Barrel Cactus, Cholla, Ocotillo, Yucca, Creosote Bush



Drawn by Matthew Kalmenoff

inhabited by the Apache squirrel; the Huachuca Mountains have a different species, the Huachuca gray squirrel; and localized varieties of the latter appear in the Santa Rita, Santa Catalina, Rincon, Pinal, and Pinaleno Mountains.

This remarkable differentiation between neighboring ranges persists throughout the animal, bird, reptile, and insect population and even applies to plants. It indicates that for centuries these mountains have been marooned fragments of a colder climate—perhaps since the close of the last Pleistocene Ice Age, some 20,000 years ago.

On the other hand, Arizona's sky islands have served as stepping stones connecting the north and south. They act as a sort of land archipelago that has carried some plants and animals across the intervening desert barrier. So there is an unusual blending of northern plant and animal life with that of Mexico. Black bear, white-tailed deer, and porcupine cross trails with the Mexican mule deer, peccary, or wild pig, and with that strange long-nosed relative of the raccoon, the coati mundi. Mexican mountain lions range up from the south, and jaguars, ocelots, thick-billed parrots, and rare coppery-tailed trogons make occasional visits. Our generally sober northern insect population is here enlivened by gaudy Mexican grasshoppers, huge multicolored moths, unfamiliar butterflies, and beetles carrying exotic designs suggestive of the Aztec. Many Mexican trees, shrubs, and flowers extend up the land archipelago, while the Engelmann's spruce and alpine fir come down from the north from mountaintop to mountaintop to make their southernmost stand in the Chiricahuas, 20 miles from the border.

With such a scrambled mixture of growing, flying, running, and crawling specimens, these ranges are happy hunting grounds for naturalists. They come from all parts of the country to track down new species and to endeavor to straighten out the tangled natural history of the region. One authority states that within its seventeen square miles,

▼ AT THE FOOT of Mt. Graham, the creamy flowers of the yucca bloom on the desert floor. A scene at the foot of Swift Trail

Weldon F. Heald photo

Herbert photo from Western Ways

⮝ PORTRAIT OF A PECCARY: an animal that is sometimes reluctant to yield ground in the presence of a human being. From a mounted specimen

Chiricahua National Monument has a greater range of plant life than any equal-sized area in the country. At any rate, 507 species of plants representing 80 families have been identified there, and all experts agree that southeastern Arizona is an unrivaled natural botanical garden, zoo, and aviary.

Favorite collecting grounds are the Huachuca Mountains, because they straddle the Mexican line and thus provide a convenient, undisturbed port of entry for southern animal migrants. For years naturalists have hit the jackpot there with an amazing diversity of mammals, birds, snakes, lizards, and insects, and each season additional varieties and species are discovered. The Mearns's quail and Mearns's woodpecker were Huachuca finds, as were the very rare Huachuca black-headed snake and Willard rattlesnake, a pygmy Mexican form only fifteen inches long. Dr. Herbert Brandt spent several summers in the Huachucas and Chiricahuas studying the birds. His forthcoming book, *Birds of Southeastern Arizona,* lists a score of species and varieties found only in these mountains.

Weldon F. Heald photo

⮜ THE CRAGS and evergreen forest of the Santa Rita Mountains rise 7000 feet above the desert of Santa Cruz Valley. Florida Canyon carries one of the finest Douglas fir forests outside of Oregon

Bill Sears photo from Western Ways

▲ The collared peccary is at home among the desert cactus or mountain evergreens. It is sometimes called a "wild pig"—an inappropriate name, for the animal belongs to a distinct family

Weldon F. Heald photo

▲ Heliograph Peak (10,028 feet) from Swift Trail, showing trees "cloud-frosted" by freezing mist in the first cold weather of fall. The fire lookout tower, 90 feet high, gleams in a casing of ice

McVey photo from Western Ways

▲ Curiosity and timidity battle in the gopher's mind as it questions your intentions in the Sky Islands of Arizona

Last year, Mr. Woodrow Goodpaster, collecting for the University of Illinois, ran a line of 100 traps up Miller Canyon in the Huachucas and caught and prepared more than 500 mammal specimens in a month. One of his prizes from a Huachuca cave was a tailless bat not known previously to inhabit the region. Mr. Charles Bogert, well-known herpetologist from the American Museum of Natural History, is a frequent visitor, as is Mr. William Woodin III, another authority on western snakes. This summer Dr. W. S. Creighton of the College of the City of New York came to the Huachucas looking for ants. He found them—at least one species hitherto unknown.

Three newcomers are Dr. Harold Edgerton, Professor of Electrical Measurements, Massachusetts Institute of Technology, Robert J. Niedrach, Curator of Birds, and Walker Van Riper, Curator of Spiders, both from the Denver Museum of Natural History. They made a field trip this year in co-operation with the National Geographic Society. Dr. Edgerton has developed a high-speed color camera using electronic flash tubes, which catches birds and insects in action with a fantastically rapid exposure. These three men concentrated on hummingbird portraits and obtained some magnificent action shots of three species.* Dr. Niedrach believes there are three or four more kinds of hummingbirds in the Huachucas—and, like most naturalist visitors before him, he is coming back.

All this scientific activity was bound to affect the ranchers, retired Easterners, writers, and artists living on the pleasant "Huachuca Strip" along the east base of the mountains. To them bugs, spiders, scorpions, centipedes, snakes, skunks, and gophers are no longer varmints, pests, and nuisances; they have become valuable specimens to be carefully snared, preserved, identified, and exhibited. For the local inhabitants are the proud possessors of an ambitious new museum.

The Huachuca Museum, housed in a fine, roomy building, once the post library of historic Fort Huachuca, was established in 1950 to preserve and graphically display permanent representative collections relating to the geology, prehistoric Indians, history, and natural history of the region. Specimens are already pouring in, and the visiting naturalists are helping by giving advice, assistance, and their specialized knowledge. But the greatest problem before the museum would seem to be to make a wise selection from an overflowing abundance of riches.

However, you need not be a naturalist or collector or expert to be struck by the unique climate, flora, and fauna of Arizona's sky islands. Even casual tourists notice them and are impressed, particularly by the larger mammals. Perhaps the mountain lion takes first place in general interest, and stories of the big cats are listened to with bated breath by newcomers and oldtimers alike.

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* For action shots of the Broad-tailed Hummingbird, see "Whistling Wings" by Walker Van Riper and Robert J. Niedrach in Natural History for January, 1950.

Weldon F. Heald photo

▲ WINTER SNOW on the Huachuca Mountains a mile and a half north of the Mexican border. Miller Peak at left (9445 feet) and Carr Peak at right (9214 feet)

These mountains are breeding grounds for the southern brown cougar. The Huachucas provide an open back door for a constant influx of these animals from Mexico, so there are probably as many today as there were 40 years ago. Whether you call them cougars, mountain lions, pumas, panthers, painters, or catamounts, they are the same powerful, lithe, tawny beasts with a deadly lightning attack and an intelligence surpassed by few wild animals. A mountain lion's diet consists of anything that walks, runs, crawls, or flies, and too often for the rancher's peace of mind, it includes his calves, colts, chickens, pigs, and dogs. Hunters, too, revile mountain lions for beating them to the kill of thousands of deer each year, in season and out.

So a bitter war of extermination has been waged for many years by ranchers and farmers against the big cats. But it would be disastrous if they were successful. Even these animals serve their purpose in a wildlife community. They act as natural balance wheels in primitive areas and are as useful in their way as are the creatures upon which they prey. The cougar is a part of our rapidly vanishing American wilderness, some of which should be preserved for the enjoyment and inspiration of generations of Americans to come.

It is difficult for a cattleman who has recently had two of his calves killed by cougars to assimilate this balance-of-nature philosophy. But fortunately in the early 1930's the United States Forest Service began to set aside a few of the wildest and most rugged sections of the national forests as examples of primeval America as it was before the white men came. In these unspoiled pieces of the original wilderness, roads, buildings, and resorts are taboo, and they are preserved solely as havens of outdoor camp and trail life.

There are two Forest Service primitive areas in the mountains of southeastern Arizona. The Galiuro Wild Area contains 55,000 acres of knifelike ridges and steep, timbered slopes rising 4000 feet above the San Pedro River valley. The 18,000-acre Chiricahua Wild Area includes fine forests, fantastic rock formations, and 10,000-foot peaks. These, together with Chiricahua National Monument and several Forest Service natural areas, total 90,000 acres of land preserved as untouched biotic communities.

But Mexico, too, acts as a great game preserve adjacent to the Arizona border. Occasionally magnificent "El Tigre," the largest of North American cats, prowls northward. Primarily a tropical animal, ranging from Mexico to Patagonia, the jaguar was encountered by early pioneers as far north as Colorado and Arkansas. A few have been reported in Arizona, New Mexico, and Texas in recent years, and a fine young specimen weighing 110 pounds was killed near Arivaca, west of Nogales, in 1949. But furtive "El Tigre" dislikes our high-pressure civilization and now visits us only on rare occasions. Golden-yellow with coal-black spots, jaguars take second place to few animals in beauty and to none in agility and stealth. Measuring up to 8 feet long and weighing 250 pounds, these great cats are among the world's most powerful and ferocious creatures.

The ocelot is another southern member of the cat tribe that now and again strays north of the border. About the size of a wildcat, this nocturnal animal is handsomely marked with irregular stripes, bands, and dots on a tan background, no two individual designs being quite the same. But ocelots may have finally abandoned Arizona's sky islands, for not one has been reported in several years.

Quite at home, however, among desert cactus and sage or mountain pine and fir are the peccaries, distant relatives of the wild boars of the Old World. They are tough pig-like animals of about 40 pounds, and they often travel in large droves. Although the white-lipped variety of Central Mexico is more formidable, the collared peccary of Arizona has little fear of humans and may be dangerous when cornered, as its sharp tusks are effective weapons. Hair-raising tales are told of peccaries running people up trees and keeping them prisoners there, but there seems to be some difference of opinion as to how dangerous this animal actually is.* I passed within 20 feet of a large male peccary on a forest trail last summer. He stood his ground, watching me suspiciously with his little beady eyes until I was out of sight. As I was on foot and never carry a gun, the feeling of uneasiness was mutual.

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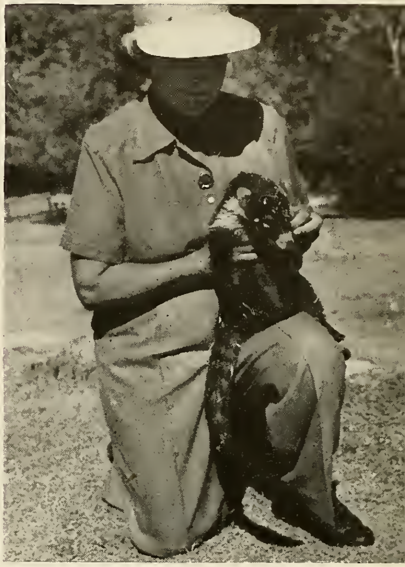
* See "Wild Pigs of the Desert," by William H. Carr, NATURAL HISTORY Magazine, October, 1946.

Then there is the coati mundi, a surprising "believe it or not" animal of Central America that ranges north into southern Arizona's mountains. If it were biologically possible, the crossing of a monkey, cat, anteater, and raccoon might result in something resembling a coati. Covered with grayish or tan fur similar to a cat's, it has a long body and tail, streamlined forward into an elongated, pointed, upturned snout. Coatis are aboreal and feed on birds' eggs, lizards, and insects. Locally called chulas in Arizona, these queer hodgepodge animals have an undeserved reputation for ferocity. You hear stories of chulas hanging from branches by their tails and dropping down to eviscerate with their catlike claws innocent, unsus-

Continued on page 95

C. F. Stoody photo from Western Ways

▲ A FOX PHOTOGRAPHED by flashlight in the region of the Sky Islands



Weldon F. Heald photo

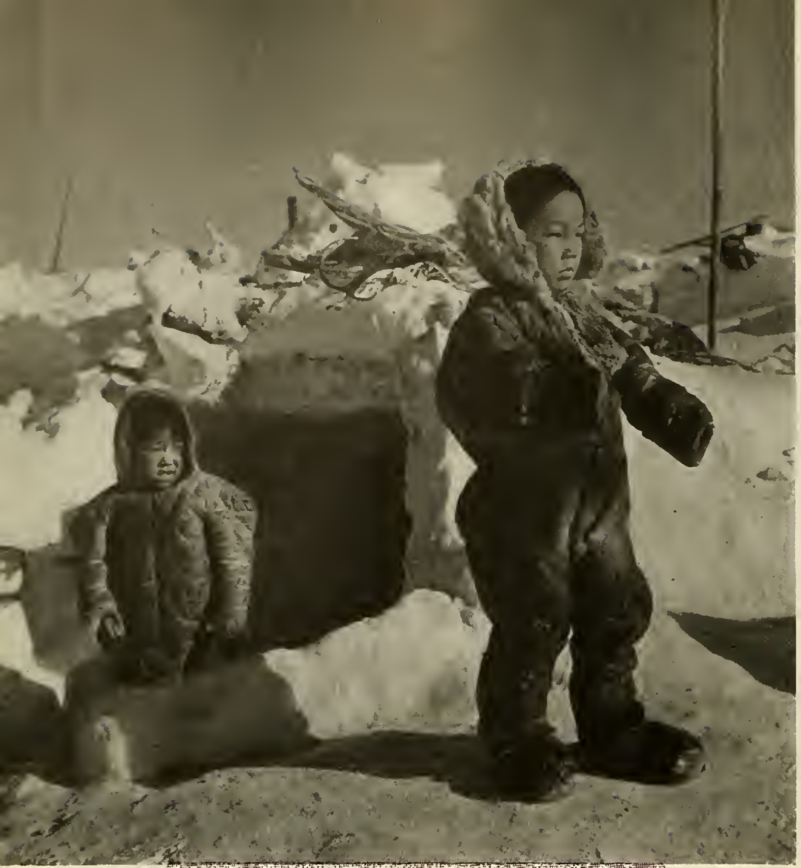
▲ THE COATI MUNDI, a distant long-nosed relative of the raccoon. It is a Central American animal that ranges through Mexico into the mountains of southern Arizona. It makes an excellent pet, but its sharp claws sometimes inflict serious scratches, even in play

Weldon F. Heald photo

◄ A CAMPGROUND in the Pinaleno Mountains among giant firs, spruces, and aspen groves

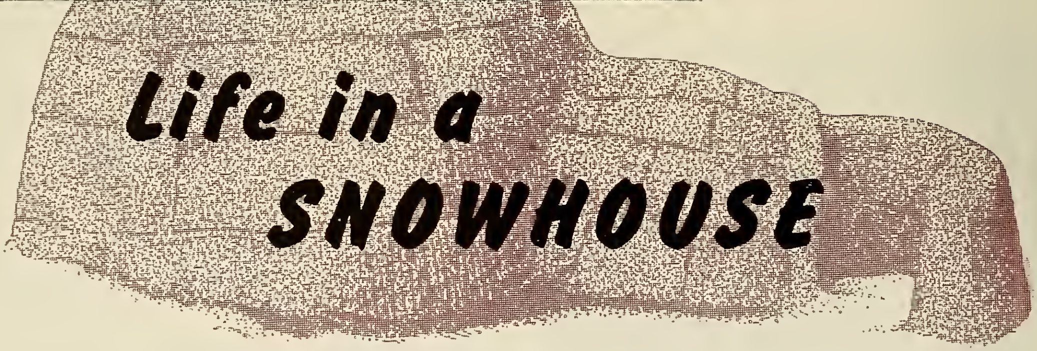
▼ AS THOUGH RISING from a sea of desert, the Sky Islands of the Mule and Huachuca Mountains project from the vast grasslands of Sonoita Valley. A view from the 9000-foot ridge of the Santa Rita Mountains

Weldon F. Heald photo



◄ ONE-PIECE SUITS of caribou skin with the hair turned in keep the children warm outdoors when the temperature is well below zero. Rifles and other implements are piled on top of the entrance roof

➤ TWO ESKIMO GIRLS, dressed in caribou skins and wearing polished brass headbands made from discarded primus stoves. Note the strings of colored beads—another modern touch



Life in a SNOWHOUSE

Glimpses of the home life of a group of people who find comfort in the depths of winter with only a dome of snow to shelter them

THE unusual photographs shown on these pages were taken by the Right Reverend D. B. Marsh, Bishop of the Arctic for the Anglican Church of Canada, who has spent much time in the Barren Grounds west of Hudson Bay. These photographs portray the winter life of a band of Caribou Eskimos of the Padlemiut tribe, who, unlike most other groups, spend most of their lives inland from the sea.

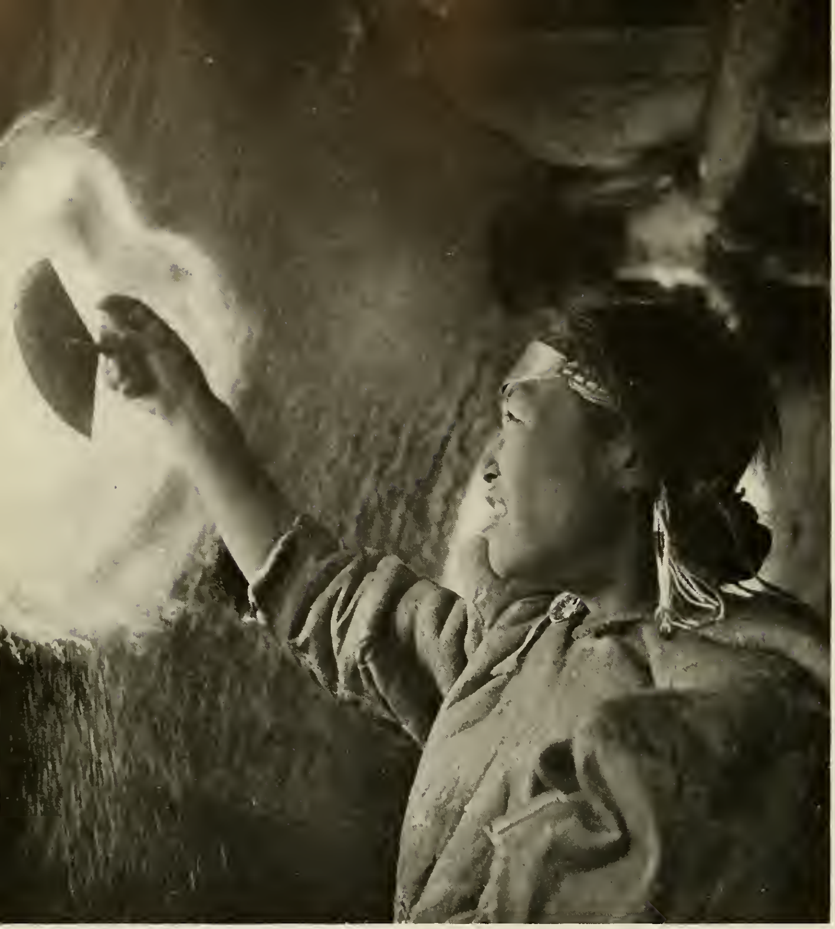
The Eskimo snowhouse has always captured the imagination of people living in lower latitudes, and many have come to suppose that all Eskimos live in snowhouses the year round. This is not the case, because the snow melts in summer even where the Eskimos

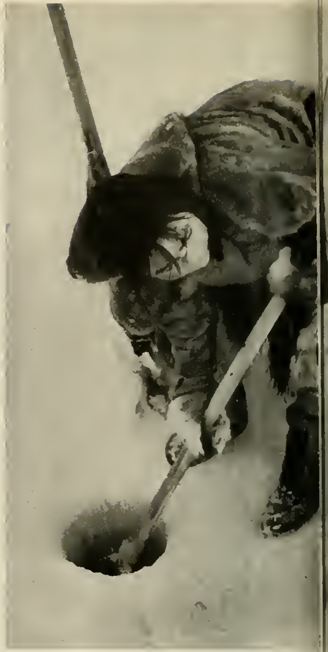
live. In fact, it would be exceptional for a snowhouse to be used after April or May, and a new one cannot be built until October or November. So snowhouses are only occupied for about half of the year, or less. Most Eskimos, furthermore, have never seen a snowhouse. But this does not mean that this unique dwelling is not exceedingly important to the 8000 or so who have used it as their only winter home for many centuries.

The snowhouse is supreme all the way from Coronation Gulf to the Ungava Peninsula in Quebec, and it is used to some extent beyond. It is regularly used on the trail by the Polar Eskimos of northern Greenland and occasionally by Eskimos in northern Alaska.

Strange as it may seem, it is possible to keep the inside of a snowhouse at from 40 to 60 degrees Fahrenheit without melting if the air outside is cold enough to neutralize the warmth within and prevent melting temperatures in the thin layer of air next to the snow.

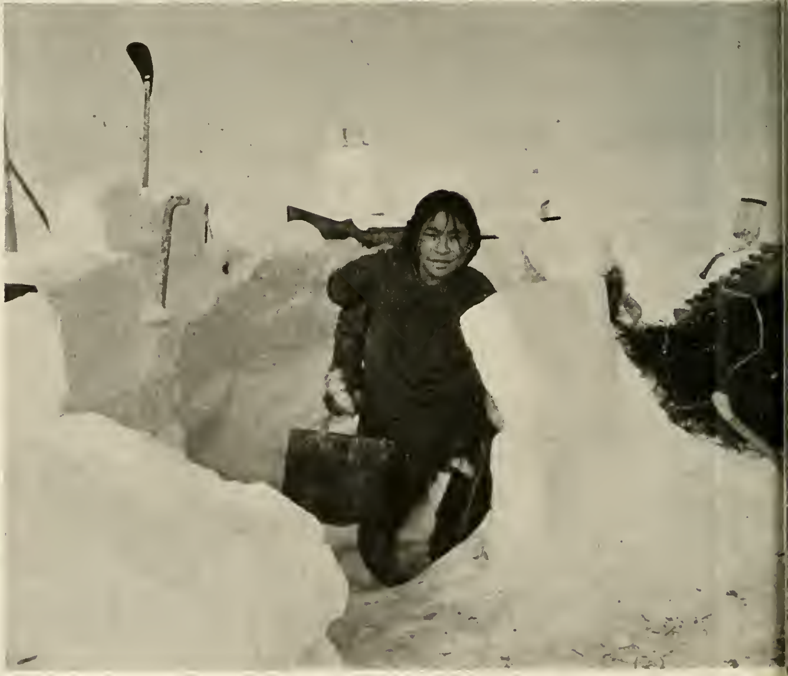
However, Bishop Marsh informs us that these Padlemiut Eskimos live in temperatures sometimes as low as 40 degrees below zero inside the snow hut. They burn scrub vegetation in the porch or vestibule but have no heat in the snowhouse itself. Most Eskimos, living on the sea, have supplies of seal oil, which they burn for heat as well as light. The caribou tallow that the Padlemiut Eskimos use is burned primarily for light. It is also clear from the photographs that they are acquainted with the primus stove of civilization.

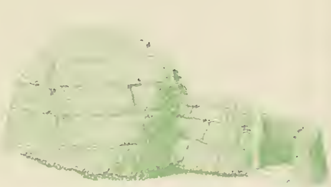




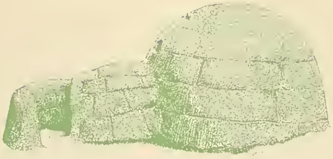
▼ Emerging from the entrance passage, the woman of the house carries a skin bucket in which to fetch water from a hole in the ice. The scoop projecting from the snow at left is used to remove the loose ice from the hole

▲ Ice windows allow illumination to enter the snowhouse. Frost collects on the ice and has to be scraped off, as shown here, with the women's *ulu*—a knife that is used for everything from making boots to cutting off bites of meat. The wooden pieces in the ceiling are tent poles, which these Eskimos always build into the upper part of the snowhouse, covering them with the tent cover

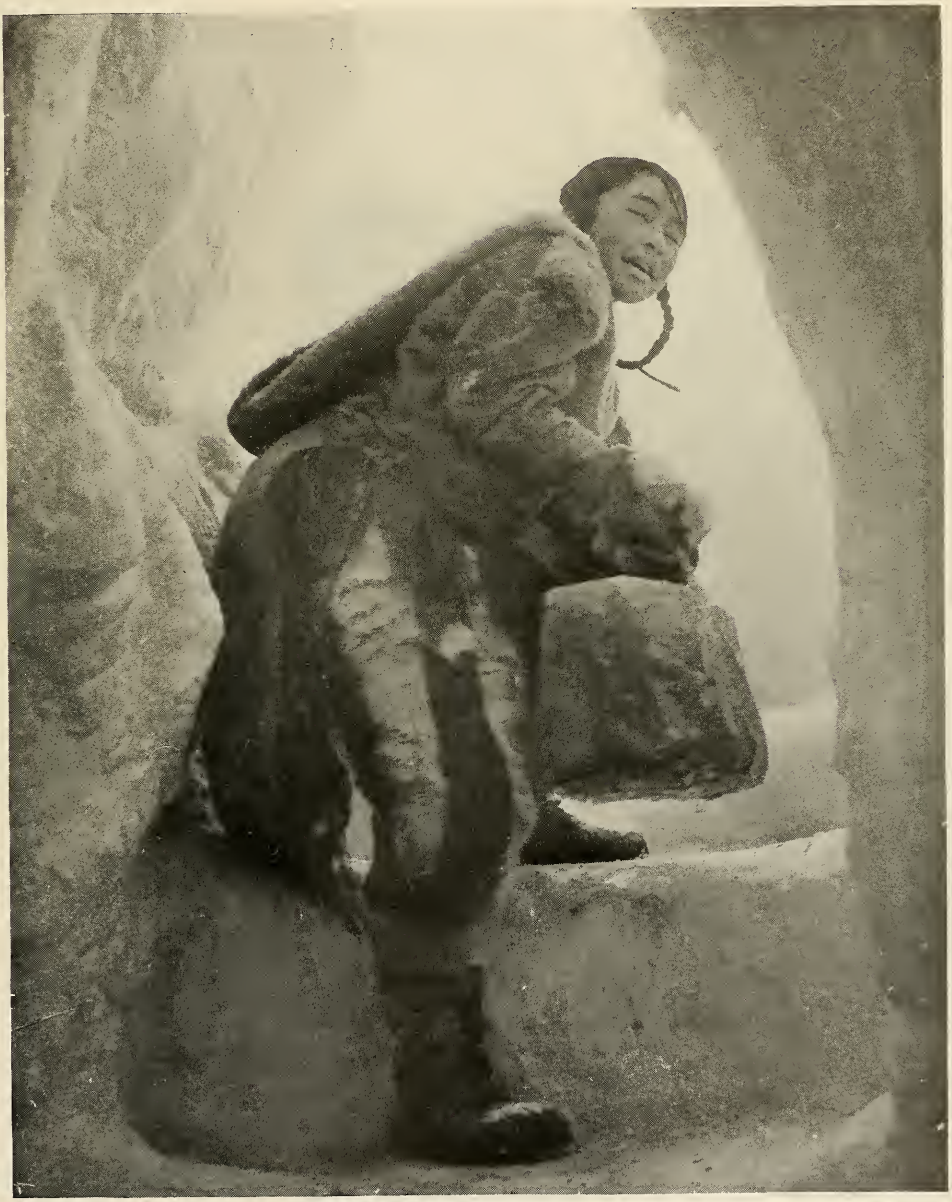




◄ THE ICE HOLE is kept open each day so that water can be drawn. The ice is chipped with a chisel and then scooped out as shown here. Coming from a lake or a river, this water will be fresh; but when camped on the sea ice, Eskimos either have to melt snow or find ice that is old enough to have lost its saltiness



▼ THE FULL BUCKET of water is being brought down the steps into the snowhouse, ready for tea or a cool drink of water any time



Charade of the Honeybee

One of the most breath-taking discoveri

By N. J. Berrill
McGill University

Edwin Way Teale photo

ANIMALS move and plants vegetate, oysters and tumbleweed notwithstanding. And movement, if it is not merely drifting with the currents of air or water, demands sensitive recordings as well as an operative mechanism. For movement is purposive. It is useful primarily because it puts the animal in the right place at the right time. Of course, the animal may only need to *stay* in the right place, as a jellyfish needs to stay above the dark void of the oceanic abyss. More often, movement is essential because it enables the creature to pursue prey or to escape capture. Another end of movement is seen in the more selfless enterprise of migration, in which the bird places its eggs in such a location that the succeeding generation will be in the right place at the right time—in other words, where the young will have the proper food and temperature at that time of year.

But whatever the aim, movement requires an animal to respond to factors that define its position in relation to the world around it. Many lowly animals move only in close contact with the ground and maintain an intimate sensory and locomotory connection through immediate touch, but most of them have some sensitivity to light to help them orientate themselves. It is when an animal leaves the sea floor recent years is that a bee can "draw a flight map" and tell its hivemates where to find the honey

to swim in a vast world of three dimensions, or abandons a pedestrian life on land for the adventure of flight, that navigation by reference to cosmic forces and internal sensations becomes paramount. Then, for most creatures, it is the light of the sun by day and the gravitational pull of the earth by night as well as day that maintain them in their course. Even the jellyfish has its eyespots and weighted sacs, whereby in light or darkness it manages to keep near the surface of the sea.

To state it another way, animals navigate mainly by the light of a star and the pull of a planet, though quite differently from the aviator with his mechanical instruments and mathematical tables. When speed is attained, the friction and pressures of the medium through which an animal travels are generally also taken into account. Friction may be lessened by streamlining, and pressures are likewise reduced, but they are not eliminated. And pressures actually have their own value. An animal that is traveling at high speed and is twisting and turning needs to be constantly responsive to stresses inherent in its maneuvers. Clearly, the creature requires an apparatus that is sensitive to speed and sharpness of turn in order to achieve precise control. So we find numerous pressure organs over the face of a fish, lying in an intricate system of surface channels. They send to the brain an accurate reflection of the water stream flowing past the head.

In the air, the flight and navigating powers of bats and birds present both wonders and mysteries, but these warm-blooded creatures are at least large enough to accommodate organs of considerable complexity. It is when we come to the insects that we gasp in wonderment, for here we see equally exquisite mechanisms for flight and the control of flight compressed into almost unbelievably small space. We know most about certain flies, particularly *Muscina stabulans*, and the honeybee, for these are the insects that have been studied the most. And while it may take a somewhat detached point of view to see beauty in a buzzing fly, its speed, hairpin turns, and pin-point landings demonstrate the superb performance of an aerial gymnast.

Something of how a fly does it has been discovered recently by Dr. F. S. J. Hollick, who devised a wind tunnel and balance such as is used for the study of aircraft but on a scale adapted to the size of a fly. Air was blown in various ways past a captive fly, and its wingbeats and other movements were delicately recorded. One flight instrument uncovered was an airspeed indicator situated in the third joint of the antennae. As air pressure increases on the head of the insect, the antennae become more and more deflected at the third joint, and the strains so set up stimulate the tension-recording sense organ at the base. This in turn sets off the various reflex adjustments of posture appropriate to the speed in question. Just how important the speed indicator is and how it influences flight is hard to say. But it does suggest forcibly that the insect not only flies but feels itself in flight and that this is important to the flight operation.

Even more informative than the antennal airspeed indicator is the turn indicator. This is an organ long known but only recently understood. It is called the haltere. Readers of NATURAL HISTORY were introduced to the operation of this organ in an article by Dr. C. H. Curran, "How Flies Fly," in the February, 1948, issue. This article was based on the first successful high-speed motion pictures showing the action of the halteres in a Drone Fly. The fly has a pair of these, one on each side, below and slightly to the rear of the wing bases, and it will be recalled that their rapid vibration provides the fly with the equivalent of a gyroscopic indicator. If the flying insect goes off course or tends to go into a spin, strains are caused in the basal sense organs, and these strains set off stimuli that initiate reflex flight stability. Without this living gyroscope, the fly could not make its sharp turns and twists without going out of control. This use of the gyroscope principle by various kinds of flies seems to be unique in the animal kingdom.

So much for flight itself. When it comes to navigation it is the bee that holds the honors.

If you were told that a bee returning from a trip to get honey or pollen could "remember" how far it had traveled, what direction it had taken to get home, how good the supply was, and in the dark in the hive could "tell" the other bees just where to go to get some more, would you believe it? This is the story that has come out of Austria since the end of the war from Professor Karl von Frisch. It sounds like a tall story, so tall in fact that a scientist at the University of Cambridge found it impossible to believe and yet at the same time found it impossible to disbelieve a man of von Frisch's standing. So there was only one thing for him to do—go to Austria and see for himself. The result is that the truth of the story is confirmed, and by a man who had originally doubted it. Such is the way of science, and in consequence we now must completely revise our ideas of what goes on in some of the tiniest brains in the world.

If men, instead of bees, were doing these things, we would say that the finder remembers how far he had traveled and in what direction, and that he tells his companions about the distance and location of food on the return, by gestures or by speaking. But the finder returning to the hive, and to her aroused nestmates, are bees. How these things are retained by the bee, and how they are transmitted to the other bees, remains an unsolved problem. Bees do not learn their "language" as man learns his; rather, without any special process of learning, they seem to be capable of their "dances" on the comb and of reacting to the dancing of hivemates. But although we do not know as yet how these results are achieved, the facts that follow have been demonstrated with clarity.

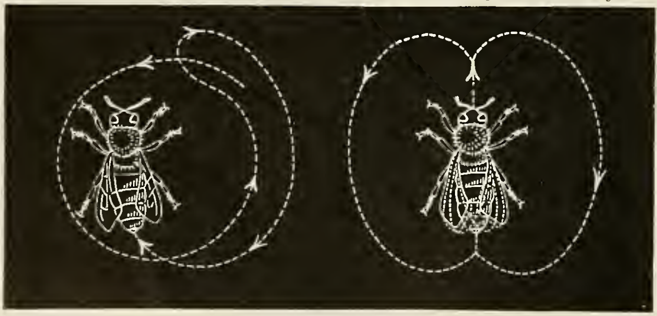
When a worker bee discovers a large source of food, she "informs" the other workers in some way through her dance on the comb. The bees that are closest follow her in the dance, become excited, and then fly out in search of the food. This has been known for a good many years. Then it was noticed that there are two kinds of dances, the round dance and the waggle dance. If the food is less than 100 yards away, the bee performs the round dance. Somehow the round dance serves as a kind of signal to other bees to go out and search for food having the scent that the dancer acquired from the flower.

When distances become greater, this sort of searching could be a great waste of time and effort, but fortunately for the hive, the bees are able to avoid this by other resources of communication. The finders then start their waggle dances. This is much more complicated than the round dance. The bee runs across the middle of the cone, waggling her abdomen from side to side at a constant rate. This is merely part of the dance, and the whole dance is in the form of a figure eight, up the middle of the cone and down one side, up the middle and down the other side. The dance is repeated a number of times.

Now, what von Frisch and his skeptical visitor found was that by timing the dance with a stop watch, they themselves could tell roughly how far away the food supply was located, within 100 yards of being correct even when it was 5 miles away. If the food was between 100 and 200 yards from the hive, the dance was repeated about 10 times in 15 seconds. When it was 1000 meters away, the frequency of the dance dropped to between 4 or 5 in every 15 seconds. This aspect of the dance has two very useful results for the hive. In the first place it excites the near-by bees, which follow behind it. And the frequency of the waltz in some way tells them how far they must fly to find the food. The teacher says in effect, "It is dark in here; stay close behind and do this after me!"

So much for the distance; what of the direction? Remember that the dance is performed in the dark on the vertical surface of a comb. The direction of the waggle-run across the center indicates the direction in which the food lies in relation to the position of the sun. If the waggle-run goes straight up the comb, the food is to be found by directly following the path toward the sun. If the run goes straight down the comb, it lies in the direction opposite to the sun. If the run goes to the right, the food is to be found to the right of the sun and at just such an angle as the run makes with the vertical line of the comb. And the same relationship holds on the left.

After Karl von Frisch, Bees: Their Vision, Chemical Senses, and Language, *courtesy Cornell University Press*



Round Dance

Waggle Dance

The dance accordingly tells the following bees both the distance and the direction, and as soon as the other bees have gained the information, off they go. If there is still food when they get there, they gather it, return to the hive, and in their turn perform the waggle dance. And so more and more bees become excited and go harvesting. When finally the food is all gone, the returning workers dance no more, and the hive quiets down.

The more you think about all this, the more remarkable it becomes. It is almost like map making and map reading. For the bee does not point out the actual direction of the food, anymore than a map actually points the way to New York. When the bee is moving straight up the cone, it means that the food supply lies in the direction of the sun, but it certainly does not mean that the sun or the food is overhead. So how is the information really conveyed? For when the dance is performed, it is in the darkness of the hive where the sun cannot be seen.

There are two forces that animals make use of to find their way in space. These are light and gravity. Even the jellyfish have little simple eyespots that tell them whether they are moving toward the light or away from it, and they have little weighted sacs that respond to the pull of gravity. All animals that move rapidly through air or water know the pull of the earth and the light from the sun. And what the bee does when she waggles up the middle of the cone is to substitute gravity for light, to substitute the line to the center of the earth for the line to the sun. This is something like what you do when you draw a map. You draw an arrow which represents the direction of north, no matter how you turn the paper.

In some way the sense of gravity takes the place of light in whatever kind of mind the bee possesses, and the angle of the climb in relation to the straight pull downward of the force of gravity somehow is measured. Moreover, it is measured to an accuracy of about three degrees. As to how it is measured, we have as yet very little idea. In fact, one of the most puzzling things about the whole business is that the bee seems to have so little equipment with which to do it. The bee that has found the food takes measure in some way of the time or effort taken to get to it. Its senses record the direction of the flight home in relation to the position of the sun. It draws a map in the form of a dance, in which a line to the earth's center becomes a symbol for the line from the hive to the sun. And other bees following in the footsteps of the dance translate the movements and directions back from gravity to light and gain knowledge both of distance and direction. This is a far cry from our old idea of forced movements. We used to say that bees and other insects moved automatically and in a simple way in direct response to light or smell or some other stimulus, forced to move toward the light or away from it whether they wanted to or not.

The problem would be difficult enough if this were all. But it isn't. Outside the hive, the bees will give the distances and directions on a flat horizontal surface. The signaling bee then uses the actual line to the sun as the measuring line, and it uses the line of the waggle dance to point the real direction of the food. In complete darkness the bee can no longer do this, which is not surprising. What is surprising is that she can draw the sun line as long as a patch of sky can be seen, even if the sun is out of sight. And it has taken a very large number of experiments to discover more of what this means.

In the crucial experiments, von Frisch placed a "polaroid" screen over an opening in the top of a hive. As he rotated the screen into various positions, he saw that the dancing bees changed the line of their dance accordingly. This meant that they were sensitive to polarized light from the sky and could orientate themselves with regard to it, just as they could to the position of the sun itself. Now this complicates matters, for there is not much likelihood that the bees have any opportunity to perform the waggle dance horizontally within the hive. Yet the experiments do show a remarkable faculty for obtaining compass directions from polarized light, and the bees should have a use for it. And very recently the lowly ant has been shown to move in accordance with the direction of polarized light.

Natural polarized light outside is the light that passes from the sun and is reflected from the high sky at right angles to the sun down to the earth's surface. Such light rays are no longer scattered but are parallel, and if we could see them we would see a pattern of light in the sky, a pattern or zoning that the bees evidently do see. The bees are able to orientate themselves with relation to the sun even under a clouded sky so long as there is a patch of blue. When there is no blue, the bee must have unobstructed vision in the direction of the sun to detect its position. It is clear from von Frisch's experiments that bees depend greatly upon the polarized light of the sky for their orientation. But remember, the dance that follows does not give the angle of flight in relation to the polarized light; it still gives the flight angle relative to the position of the sun. The pattern of polarized light is used by the bee to locate the position of the sun, and the bearings are made in relation to that. And then, in the actual dance within the hive, it is translated on a vertical surface into a relationship with the plumb line of gravity.

Such is the way of science. We remove the veil in front of one mystery only to find a greater mystery lies behind.

Edwin Way Teale photo

Honeybees on apple blossoms

Laboratorio da Fotoptica

THE Vani

< CAMAYURA CHIEF with his wife and child

Deep in the wilderness of the Upper Xingu River in Brazil, science is studying some of the world's last remaining primitives

By EDWIN D. NEFF

HARDLY a day's plane trip northwest of Rio de Janeiro, in the verdant wilderness of the Brazilian Matto Grosso, live some of the strangest people on earth—the Indian tribes of the Upper Xingu basin. Here, in daily practice, are fantastic customs dating back to the hazy origins of men in the New World, perhaps 25,000 years ago. Deep in these little-known forests are painted men, playing sacred flutes, practicing sorcery, believing that tribal gods created their ancestors from trees.

Few white men have seen these naked, brown-skinned savages, now vanishing from the face of the earth. Because they are hemmed in from the white man's world, and even from other tribes, by geographical barriers, the people of the Upper Xingu basin (pronounced SHING-goo) have been able to survive unchanged, unspoiled. Their homelands are a hidden world, fenced in by the hazardous rapids of unnavigable rivers.

Today, this picture is changing. Brazil, eager to open up its vast, rich interior, is building roads and settlements and airstrips. Inevitably, white men's diseases have reached the natives, and before long, these tribes will probably become extinct. Hardly more than 700 Indians remain in the Upper Xingu River basin. For this reason, Dr. Kalervo Oberg, an anthropologist backed by the Smithsonian Institution, the U. S. Department of State, and the Escola Livre de Sociología e Politica de São Paulo, has visited these tribes and others in Brazil every year during the dry season since 1946—writing what may be the final chapter in their history.

But before we tell you more about these vanishing tribes, little known and almost overlooked by the rest of the world, let's see why anthropologists go to so much trouble and often danger to study them. What can the world of jet planes, atom bombs, and electronic computers learn from men who still hunt with bows and arrows, live in grass houses, and believe in spirits? We must remember that human nature

▲ A TYPICAL VILLAGE of the Upper Xingu. The huts are made of saplings and grass.

hing Tribes

OF BRAZIL

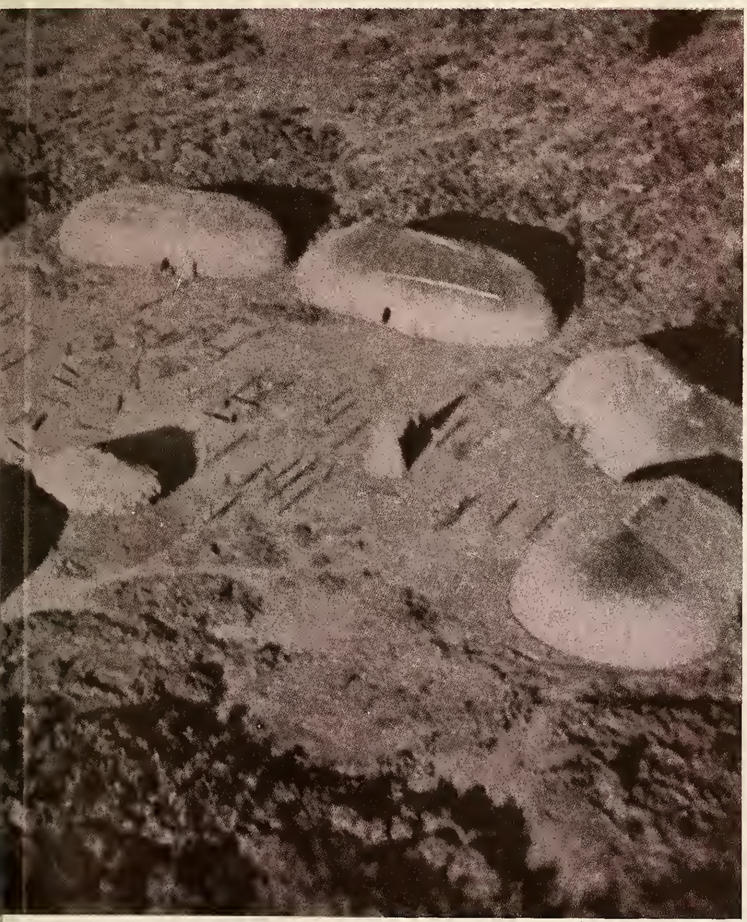


Photo by Harry B. Wright

me of the larger ones house five to eight milies. There may be a large central house containing ceremonial objects. This aerial view was taken on the Tuluene River

Photo by Harry B. Wright

▲ TWO GIRLS of the Tuluene River, after bathing. They wear no clothes any time

is far more complex than physics and mathematics. Man constantly perfects the weapons of war, for example, without discovering how to prevent war; and despite his brilliance in the physical sciences, he still does not understand himself.

Like the biologist who begins his studies with the one-celled plants and animals, the anthropologist begins with the simplest groups of people. South America is the only part of the New World where there are peoples still unspoiled by what we call civilization. And in these small, primitive groups a single scientist can observe the entire culture. He can see how these men have adjusted themselves to their natural environment and to their fellow men.

In addition, Dr. Oberg is trying to learn where the Upper Xingu groups relate to other aboriginal peoples of the New World and, even further afield, to the peoples of the Old World. He began his studies at the Jacarei airfield on the Tuluene River, deep in the interior of Brazil, the region known as the

Photo by Harry B. Wright

➤ A CAMAYURA GIRL, who will see many changes in her ancient homeland

➤ TAKUNÍ, a Camayura, shooting fish with the bow and arrow

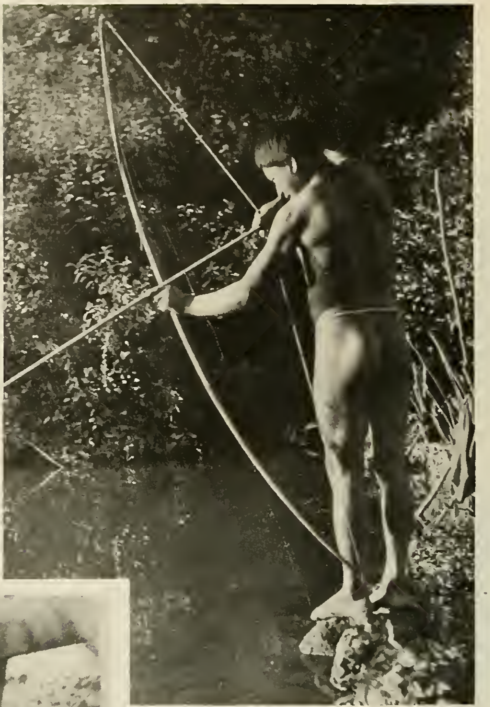


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Photo by Harry B. Wright

◄ THE WOMEN prepare a variety of dishes based on the products of a simple agricultural and hunting economy. The white men sometimes found gifts of cooked fish and terrapin distributed among their bedcovers

Matto Grosso. The airfield was built by the Roncador Xingu Expedition, spearhead of the Brazilian Government's efforts to open up the country's wild interior.

Here the Xingu River and its five great tributaries form a triangular basin enclosed between longitudes 52 and 55.5 West and latitudes 12 and 14 South. The basin is bounded on the south by the semiarid Planato do Matogrosense, on the east by the Serra do Roncador, and on the west by the Serra Formosa.

Within this basin, fortified by dense forests and scarcely navigable streams, Dr. Oberg found several tribes of truly primitive Indians, totaling 733. They were at peace with one another, but they united against their enemies, who threatened from all sides of the

Photo by Harry B. Wright

▲ A **Trumaí Indian** making fire in the Upper Xingu country

basin. In a sense, they have discovered the working principles of the United Nations. They speak different languages but understand something of each other's tongues, and their culture is basically the same. There is plenty of room and plenty of resources for all. Tribal specializations in crafts result in constant trading among the different groups.

The Indians' wild and beautiful country is filled with eerie sights and sounds and smells. There are strange — and familiar — animals: tapirs, jaguars, plains deer, cougars, wild pigs, otters, anteaters, monkeys, parrots, macaws, toucans, hawks, eagles, buzzards, alligators, and terrapins. In late August, the flowering jacaranda trees turn the forests into a tropical garden. Mangabeira trees are heavy with plumlike fruit, and the timbo blossoms fill the air with a rich, narcotic perfume.

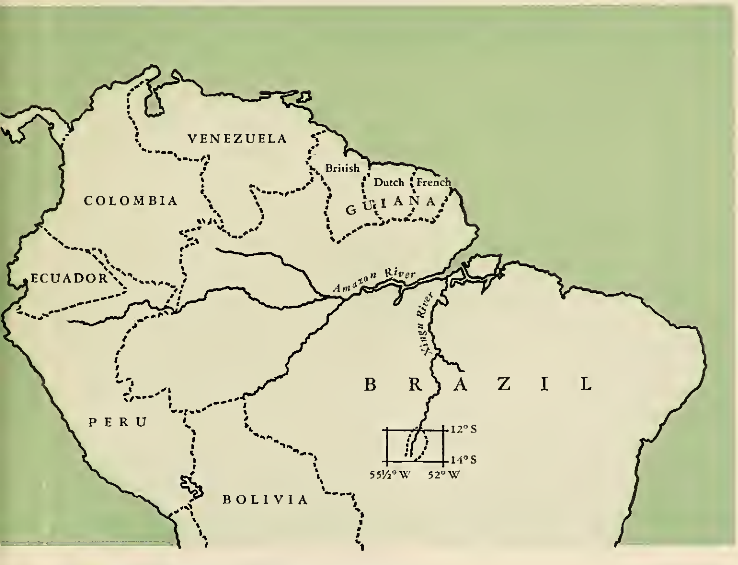
Wet and dry seasons are sharply marked. Beginning in September and continuing through April, there are almost daily thundershowers. But there is hardly any rain from May through August. During August and September, Indian fires clear the land for planting, and a constant haze hangs over the basin.

Dr. Oberg began his study of the northern Matto Grosso tribes at the start of the dry season in May of 1948, at the village of Tuatuari, near the Jacarei airfield. Since the basin Indians are similar in most respects, he selected the Camayuras for detailed study because they were the easiest to contact. As he stepped off the plane at the airfield, a naked Camayura approached him, touched his chest, and through an interpreter asked his name. Soon, Dr. Oberg's party was surrounded by 30 Camayuras—men, women, and children. They began opening the white men's shirts to feel the hair on their chests, running their hands through the visitors' pockets, and tying and untying shoelaces.

They were fascinated by "teeth that come out"—that is, dental plates. They asked endless questions about the family relationships of Dr. Oberg and his party and were deeply puzzled by the presence of a Japanese, who didn't seem to fit. Later, when they saw a picture of a Japanese in a magazine brought by Dr. Oberg, they decided it was the likeness of a brother to Oberg's Japanese student. The reason for the curiosity about the visitors' family relationships was the Camayura's kinship society. To know how to treat someone you must know his family ties.

Fathers and fathers-in-law are treated with great respect. Mothers-in-law may not be spoken to at all, except through another person. Brothers treat each other as equals. Fortunately, the Camayuras decided to treat Dr. Oberg's party as brothers.

That decision brought somewhat more intimacy than the scientists



had bargained for. Camayura children began jumping about on the white men's beds. (They were used to hammocks.) Camayura women brought bits of cooked fish and terrapin and distributed them among the bedcovers. (The visitors might get hungry in the night!) Sometimes a Camayura woman would offer Dr. Oberg the tribal *pièce de résistance*—a dainty cake of manioc flour. Then she would squat on her heels and watch his face for signs of appreciation. When the visitors gave the natives food, there was a noisy smacking of lips and appreciative grins. This was considered ordinary courtesy.

The visitors got no privacy at all. Natives wandered at will around the white men's quarters, examining everything and hoping for brown sugar and beads. Naked children scrambled over Dr. Oberg's lap while he struggled with his notes.

The first Camayura with which Dr. Oberg attempted to do business was Nilo, a sixteen-year-old boy. Nilo, though in many respects a slender reed for an anthropologist to lean upon, had at least been taught Portuguese and could act as interpreter and guide. Unhappily, and despite lavish payments of brown sugar, Nilo hated interviews. When Dr. Oberg tried to pin him down on a bit of tribal information, Nilo would grunt, "Look, guy, I told you all that the day before."

Once, someone foolishly loaned Nilo a rifle, and he accidentally shot another native boy. Although the lad survived, Nilo was in bad odor with his tribe. Further, he had been caught stealing sugar. His father decided he was immature and sequestered him behind a screen in the family hut to whittle arrows and learn to play the sacred flute.

The incident was typical of what Dr. Oberg found at the Jacarei airfield—a perplexing mixture of old and new cultures. At this point of contact between men of different worlds, Indians of ancient culture could get penicillin for their ills, while airplanes roared above dugout canoes and radio newscasts from Rio, New York, and London competed with native gossip.

Back in the forests, Dr. Oberg found the Camayuras living in villages of grass houses, elliptical in shape, and built around a larger, central house where the sacred objects were kept. As a partial defense against enemies, the villages were located on narrow streams almost covered by overhanging vegetation and hence difficult to approach by canoe. Thus invaders usually approached overland, spotting the Camayuras by smoke from the village fires. When the Camayuras became aware of enemies, they abandoned their villages, retreated into the forest, and hung their hammocks among the trees.

Camayura villages are only semipermanent. When the soil near by is exhausted by crops and the fishing depleted, the Indians move to new sites and plant again. But they continue to return to the old homesteads for harvesting until the new crops begin to bear.

Home building is a community affair. Everybody helps his neighbor cut saplings, collect and bundle the tall grass, and erect the house. Afterward, there is feasting. The houses vary in size, the larger ones being roomy enough for five to eight families. The wife's hammock is strung nearest the hut floor, with her husband's directly overhead. The children's hammocks are near by. On the floor, beneath the wife's hammock, a fire is built to ward off insects and provide heat. She is expected to keep it going all night. Since the Camayuras wear no clothes, there are frequent body burns caused by sparks striking the sleepers.

The Camayuras' chief crops are manioc, sweet potatoes, maize, and peanuts. Crops are planted at the start of the rainy season and harvested in March. The women spend most of their time preparing meal and flour from manioc roots, which must be carefully processed to eliminate a deadly poison, prussic acid.

The Indians never tire of talking about manioc. They believe it was the gift of the god Mavutsine, creator of the Camayuras, who warned them to guard it carefully from the forest animals. The ancestral Camayuras were careless, however, and the original, beautiful green field of manioc was all but trampled out by deer. Only a tiny sprout remained, and from this grew all future manioc. None was so beautiful as the first, however, and to this day the Camayuras hate deer.

Piquia fruit (resembling avocado), cotton (for hammocks), and urucú* are also grown. The latter provides seeds with a brilliant red pigment, which is mixed with oil or water and smeared over the body in decorative, geometrical designs. Tobacco, another crop, is believed to have magical properties and may be smoked only by mature men.

Aside from the plant staples, the Camayuras' chief food is fish. (Meat is rarely eaten.) They use one of the most unusual methods of fishing known. All the fancy rods, reels, and multicolored flies of modern sportsmen are clumsy claptrap beside Camayura methods. For these primitive men use a drug to stupify fish, rendering them so helpless they can be picked out of the water by hand or easily shot with bow and arrow as they flounder near the surface.†

The drug is rotenone and is contained in the sap of the timbo vines, which grow wild near the jungle streams. The vines are gathered in bundles and tied to crossed stakes driven into the bed of a stream or pond so that the bundle is just above the surface of the water. Indians then beat the bundles with sticks for about two hours and spread the sap by jumping up and down in the water.

Within about two hours, as the drug begins to take effect, the fish surface, gasping for air. A great shout goes up, and archers, erect in the bows of canoes or poised like statues along the shore, begin to shoot. There are cheers for successful marksmanship and good-natured boos for misses. By nightfall, the fish are so drugged they can easily be scooped by hand into baskets.

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* It is possible that urucú is not actually cultivated but left standing after other trees have been cleared away.—Ed.

† This practice may have been borrowed from neighboring tribes in recent times. Von den Steinen did not find it in this area in 1884.—Ed.

Photo by Harry B. Wright

▲ FINE PHYSIQUES, strengthened by a natural life in the wilderness, may prove no match for the diseases of civilization. Camayura wrestling

▼ ENORMOUS FLUTES, several feet long, are important ceremonial instruments among the Camayuras

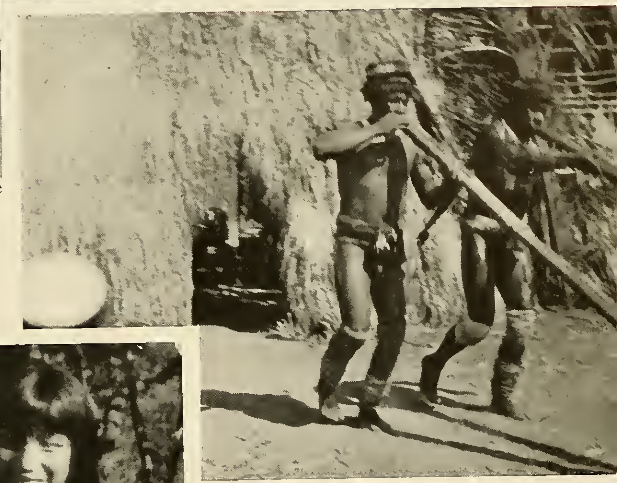


Photo by Harry B. Wright

Photo by Harry B. Wright

▲ OWING to the unnavigable rivers that protect their domain, these gentle "savages" have seen few white persons. The Brazilian Government has kept adventurers and unscrupulous persons away from the Camayuras lest exploitation degrade them

Camayuras also eat terrapin and terrapin eggs. The latter are hunted at dawn throughout August and September, the egg-laying season. Since the eggs are rich in oil, the Indians are sleek and fat during these months. The terrapin are caught barehanded by swimmers who stalk them in the rivers, seizing the animals by their tails as they dive. The terrapin may be sliced up and boiled or roasted alive, back-down on the coals.

Hardly less strange than their fishing technique are the Camayuras' superstitions. They believe that their ancestors were made from *Camiuva* trees by the tribal god Mavutsine, who carved a statue of a woman, blew cigar smoke over her, and stroked her with his hand to bring her to life. Then he made the sun and the moon and all the friendly tribes of the Upper Xingu. The moon, however, turned out to be a mistake, for it created the enemies of the Xingu men.

Mavutsine also made the first *jakui*, or sacred flutes, which still figure in the ceremonies. The flutes are cane, 36 inches long, and 3 inches in diameter. They have a deep, resonant tone, which the Camayuras believe promotes good fishing. Oddly, these flutes may not be looked upon by women. A woman who looks at one, even though by accident, is subject to gang assault. Dr. Oberg could find no explanation for this, no precedent, and no mention of it in other writings about South American tribes.

Shamanism, the art of sorcery and healing, is another curious Camayura custom. They believe it was taught their ancestors by Bem-tevi, the yellow-breasted flycatcher. Shamanism enables a man to cure another's illness or to bring vengeance upon his enemies. Sickness, according to these natives, is caused by the injection of foreign objects into the body by an enemy. Healing results when these objects are removed by the shaman. Any male adult becomes a shaman after serious illness, but only a few have the gift of healing. When a man becomes ill, his father or another old man initiates him into shamanism. The pair smoke tobacco until the patient falls into a trance. Tobacco is believed to have the power to summon spirits, Mama'ē, with whose help the shaman sucks out the foreign objects from the patient's body. If the patient recovers, he becomes a shaman, with the right to smoke. Women never smoke and never become shamans.

Contrasting sharply with the clean and friendly Camayura were the surly, disillusioned Nambicuara Indians, whom Dr. Oberg found to the west of the Xingu. To reach the Nambicuara, Oberg's party had to take a 400-mile truck journey from Cuiabá, capital of the Matto Grosso, to Utiarity. Since gasoline sells for $1.00 a gallon in this region, Dr. Oberg was lucky to be able to share expenses with a party of about 15, including 2 missionaries on their way to convert the Indians.

From Cuiabá to Porto Velho on the Madeira River, a government telegraph line cuts a narrow corridor through the vast, unknown territory of northwestern Matto Grosso. Along this line, the government has set up telegraph stations and a makeshift road past Utiarity to Burity. Beyond, the road is hardly more than a path. Since 1912, when the telegraph line was completed, the corridor has been a trail for venturous travelers seeking gold, diamonds, rubber, and Indian souls.

Most of these adventurers were shoestring operators with second-hand trucks and scanty supplies. They planned badly. They hired Indians at slave wages and deserted when food ran out. Worse, the Indians then became infected with venereal and other diseases against which they had no resistance. These exploitations have reduced the eastern Nambicuara to hardly more than 100, and they are split into little, nomadic bands. They are sullen, resentful, and suspicious of whites. They realize that white men are richer than they and that competition is impossible. They also realize that white men brought the diseases that are killing them off.

Dr. Oberg made his first contact with the Nambicuara at Utiarity after an uncomfortable journey over ferry crossings, hazardous bridges, and dry, sparsely-grown plateaus. He had supposed he would have to go far beyond Utiarity to locate the Nambicuara, and he borrowed a pack train of mules and oxen from the missionaries. But a band of about eighteen Nambicuara suddenly appeared in the village to get medical treatment for one of their men who had running sores.

He found them a miserable group; they seldom bathe, and they sleep on the ground instead of in hammocks. Their bodies were covered with particles of decayed meat and fish. They suffered from internal parasites, and their stomachs were painfully distended. During the dry season each year, they are lean and hungry, for by the end of June they have eaten the few crops they plant. They survive only by exploiting all resources of the area.

The Nambicuara are nomadic hunters and collectors. In addition, they plant manioc, maize, and beans. Except when only the men go after large game, the whole family hunts. These "hunting" trips are actually collecting expeditions, for the hungry Indians seize anything edible. The husband walks in front, followed by the wife with a burden basket on her back and an infant strapped to her hip. The other children bring up the rear. The family collects fruit, nuts, snakes, lizards, insects, wild honey, grubs or larvae, and on the way home, firewood.

The men hunt in bands for wild pig, surrounding the animals in the brush through skillful teamwork and shooting them with arrows. Few escape. The catch is divided up according to the size of the individual hunter's family, and all parts of the pig are eaten. Anacondas and alligators also are hunted, the latter in water holes into which the Indians shoot blind until the snake ceases to struggle. They poke about under logs with their bare feet for hidden alligators. Luckily, the Indians are quick-footed enough not to get bitten.

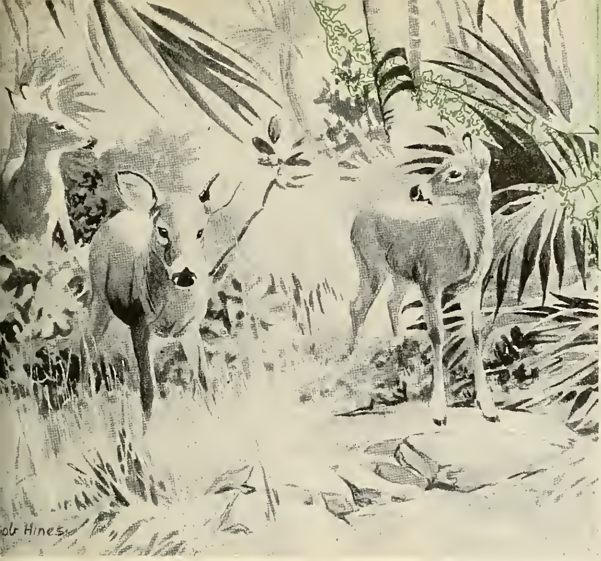
The Nambicuara are constantly at war with hostile tribes to the north. Their chieftains prepare the men for war by taking them into the forest and convincing them the men to the north are "bad" and must be killed. War chants and the manufacture of clubs and arrows follow, and on the night before the attack, the warriors paint their bodies with latex sap and red urucú. Curiously, they stuff leaves into holes in the ground to prevent their war chants from "leaking" to the enemy. They also burn leaves and the skins of anteaters and toads, hoping the smoke will blind enemy scouts and stupefy the near-by enemy villagers.

When the attack begins, the chieftain remains behind while the younger men raid the village. Loot is carried back to the waiting chieftains, who thus have a continuing motive for promoting war.

As we noted, the Nambicuara have an entirely different attitude toward white men from the Camayura. Their hostility is partly due to their more frequent contact with whites and partly to the different motives of the whites with whom the two groups of Indians came in contact. The Brazilian Government has kept adventurers and unscrupulous persons away from the Camayura and has maintained a friendly policy toward them.

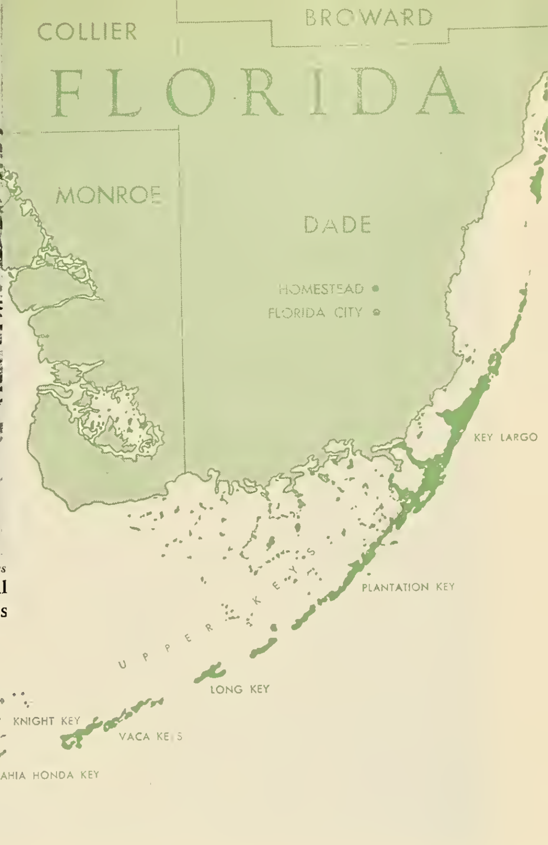
Without this protection, the Nambicuara were overwhelmed in their collision with the advanced technology and greed of white men. Very much the same thing, we must recall, happened to our own North American Indians. And to cite an extreme example, the Marquesans of the South Sea Islands were so crushed by European culture introduced by the French in the last century that they even ceased to breed and nearly died out.

The lessons these primitives can teach us, anthropologists believe, could profitably be studied by our Government before it undertakes to introduce American technology to less advanced peoples under the Point IV program. The Russians are hopefully waiting for us to repeat old mistakes.



Drawing by Bob Hines

▲ Real estate development, gunners, and speeding cars will wipe out the last of Florida's little Key Deer unless a sanctuary is established at once



Can We Save the Key Deer?

These unique "toy" deer, no bigger than a large dog, face final extinction in their native Florida Keys unless action is taken at once to save them

By Robert P. Allen

Research Associate, National Audubon Society

SOME years ago, in a restaurant in Key West, where Spanish yellow rice, *boyos,* and turtle steak were a new and pleasant experience, I was astonished at the diminutive size of the mounted deer heads displayed here and there on the walls. They seemed too small to be real.

My companion explained, rather casually I thought, that these were heads of a little deer that still inhabited certain of the Lower Florida Keys. The eyes, he went on, were the normal size supplied to taxidermists, but quite obviously they were far too large for these tiny heads. Even the antlers were miniatures.

It was my first trip to the Florida Keys, and by the time we reached the *boyos* and the toy deer, I was completely surfeited with extraordinary and unheard-of natural wonders. Many of them were difficult to believe. It was possible to accept the region as subtropical, but the improbable combination of crocodiles, pink spoonbills, pirate gold, rock beauties, butterfly fish, panthers—and now toy deer—seemed like too much to swallow in one day. After all, this was Florida, U. S. A., not the Great Barrier Reef on the other side of the globe. Or Africa, or the Land of the Golden Fleece.

Next day I looked at some of the heads more closely and found them to be real enough. I also talked with local people, who told me that the tiny animals "have always been

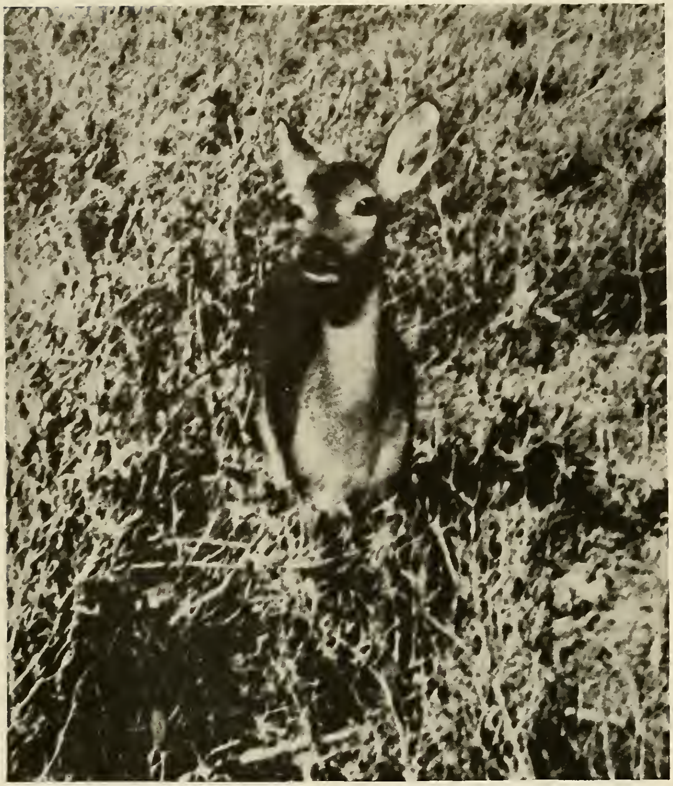


Photo by A. Ernest Sawyer, courtesy Fish and Wildlife Service

▲ So far as Natural History Magazine could ascertain, this represents the only time that someone shot Bambi's little cousin with a camera instead of a gun. There may be no more than 30 of the appealing little animals left

here," although the range was then limited to a few keys in the vicinity of Big Pine Key, 20 miles northeast of Key West. Apparently the deer were hunted in and out of season and were greatly reduced in numbers. We visited their habitat on Big Pine, and after tramping through the pine and palmetto, the mosquitoes and heat, without seeing anything except a few small tracks in the mud of the road, we could agree as to their apparent rarity and even wonder that these miniature deer survived at all. Fires had swept through the slash pine (*Pinus caribaea*) not too long before, leaving a floor of bare, badly eroded rock and wide areas of blackened trunks. There were adjacent ridges of tropical buttonwood *(Conocarpus erecta)* that were free of fire damage, as were the adjacent fringes of black and red mangroves, but at first glance it seemed a poor environment. At several places on the road there were eloquent little heaps of empty shotgun shells, some of them not even weathered.

During the next few years, an effort was made by the National Audubon Society to prevent the shooting of the deer through the cooperation of landowners and state authorities. Educational work was undertaken in Key West. A bill was passed by the State Legislature giving temporary protection, and it was later replaced by a Game Commission regulation. Then came World War II, and our concern for the deer, along with many other projects of a similar nature, was put aside. Only today, a dozen years after our first interest in their predicament, are definite steps being taken to learn more of these unusual animals and to preserve them and their habitat.

What does the Key Deer look like, and what are these little animals doing in this isolated and seemingly unfavorable environment? Many people have asked these questions.

The Key Deer *(Odocoileus virginianus clavium)* is the smallest of the several races of white-tailed deer. There are some who believe that it is sufficiently different to be placed in a separate category as a distinct species, but this is a problem for the systematists and is only of academic interest to the conservationist. The fact that it is unlike our other native deer on so many counts, and that its complete destruction would mean the extinction of a unique and irreplaceable form, is more than enough to enlist our sympathy and our strong interest in its survival.

In general appearance the Key Deer looks like a diminutive whitetail, except that its proportions never approach the magnificent, as in large bucks of the Michigan or Pennsylvania forests. It is a dwarflike animal. The largest bucks, which have been reported to reach a maximum weight of 55 pounds, with an average of something under 50 pounds, are built along miniature and almost elfish lines. They are about the stature of a big dog. Their pocket size, in fact, is their greatest appeal. That such handsome and delicate little creatures should be cruelly and needlessly killed, sometimes with a hand ax as they bravely attempt to escape the hounds by swimming, is enough to stir the most disinterested citizen to action. By comparison, the 300-pound whitetail bucks of the northern forests are not only giants fully six times as large as the biggest Key Deer, but one feels that they are stronger, more capable animals, better able to take care of themselves. The little does are proportionately smaller, and one individual that had been killed by a car on the Overseas Highway on Big Pine Key weighed only 35 pounds, which is probably close to average for adult females. I helped Jack Watson, of the U. S. Fish and Wildlife Service, skin this specimen, and she was an old deer with brown-stained, well-worn teeth. She had an over-all length of only 38 inches and measured 26 inches high at the shoulder.

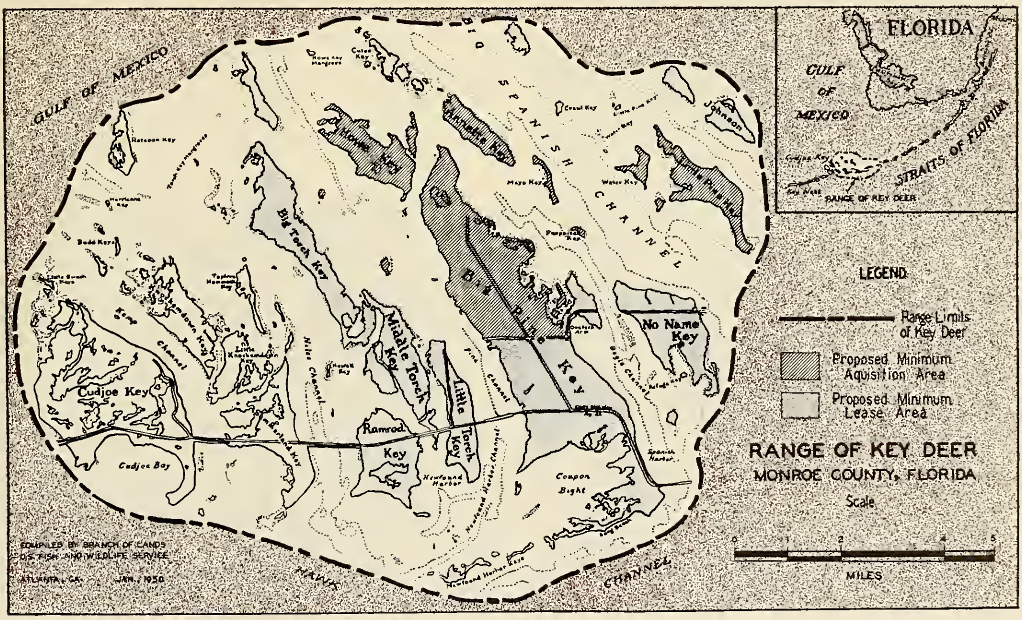
There are several possible explanations as to how these pygmy deer happen to occur in this isolated spot. The most convincing is the theory that they went there with the original fauna of the postglacial period, perhaps as normal-sized deer, evolving to their present size and character in that insular environment. During the Pleistocene period, the melting ice of the several interglacial stages raised the water level of the oceans, bays, and gulfs. It is believed that during the last or Peorian interglacial stage, the so-called Pamlico Sea covered southern Florida up to about the present 25-foot contour. This means that all of southern Florida as we know it today was under water as far up the peninsula as the Caloosahatchee basin.

During the last or Wisconsin glacial period which followed there was a drastic lowering of water levels, perhaps to as much as 20 feet or more below present levels. As a result, there was a long passage of time during which the Florida mainland of today was joined to the entire string of keys by a land bridge. Florida Bay was a dry lowland, traced with irregular estuaries. Deer passed easily from the mainland to almost any point on the keys. As the water level gradually returned to the present shore line, deer and other animals were probably cut off and eventually isolated.

There are marked differences between the Upper and Lower Keys. The former—the keys closest to the mainland—were once a living coral reef, and the present heights of land were once two fathoms or more beneath the sea. The limestone formation of these keys is unique, as is the dense growth of mahoganies, gumbo limbos, wild tamarinds, and other tropical hardwoods. Much of the hammock, however, has long since been destroyed to make room for plantations of pineapples, tomatoes, and other crops, and is still giving way to provide space for tourist cabins, lunch stands, and winter cottages.

The Lower Keys, from Big Pine to the Marquesas, are built on a formation of Miami oölite. This is identical with that which extends beneath Florida Bay and across a portion of Monroe County on the mainland, across all of Dade County and a portion of Broward. These keys are simply the higher areas of land that remained above the sea after the fluctuating levels began to rise toward their present height. On them only limited patches of hardwood hammock remain, most of the larger keys being covered with slash pine and palmetto.

The isolation of the Upper and Lower Keys from the mainland and from each other is fairly apparent. The flora of the upper group is chiefly Bahaman, while that of the lower group has much in common with the mainland in the pinelands around Homestead and Florida City, although West Indian and particularly Cuban plants are not uncommon. Once the sea shut off escape routes from these two regions, each developed its own peculiar characteristics. Deer trapped on the Lower Keys were cut off by Bahia Honda Channel and by the wide stretch of open water lying between the Bahia Honda group of keys and Knight Key, at the southwest extremity of the Upper Keys. Key Vaca, Long Key, and other

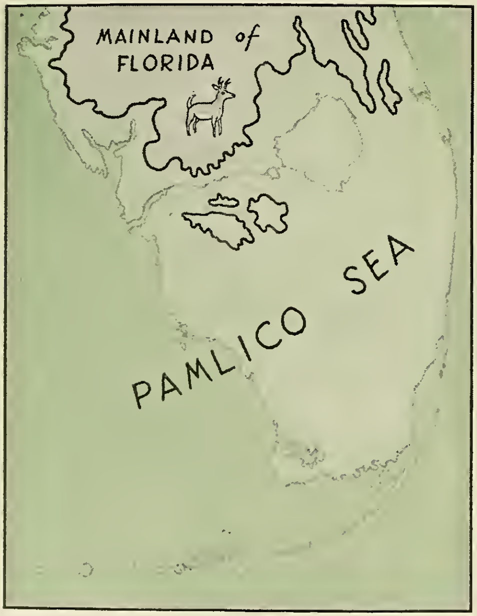

GULF OF MEXICO
Racoon Key
Torch Key Mangroves
Howe Key Mangroves
Cutoe Key
Big Spanish Channel
Crawl Key
Little Pine Key
Water Key
Mayo Key
Water Key
Porpoise Key
Johnson
Budd Keys
Little Swash Keys
Big Torch Key
Kemp Channel
Sumerland Key
Little Knockemdown Key
Cudjoe Key
Cudjoe Bay
Niles Channel
Middle Torch Key
Little Torch Key
Ramrod Key
Newfound Harbor
Newfound Harbor Channel
Newfound Harbor Keys
Pine Channel
Big Pine Key
No Name Key
Bogie Channel
Spanish Harbor
Coupon Bight
HAWK CHANNEL
COMPILED BY BRANCH OF LANDS
U.S. FISH AND WILDLIFE SERVICE
ATLANTA, GA. JAN., 1950
FLORIDA
GULF OF MEXICO
STRAITS OF FLORIDA
Key West
RANGE OF KEY DEER
LEGEND
Range Limits of Key Deer
Proposed Minimum Aquisition Area
Proposed Minimum Lease Area
RANGE OF KEY DEER
MONROE COUNTY, FLORIDA
Scale
0 1 2 4 5
MILES

more or less isolated islands in the upper group may have been shut off also, so that they too could have developed variant races of deer, as they did, to our knowledge, develop subspecific forms of the raccoon. However, there are no records. Key Largo provided a suitable habitat, but there was probably a tendency for the deer on this key to mingle with whitetails from the near-by mainland, so that a variant may never have developed. In witness of this, there are a few deer on Key Largo today that appear to be identical with the mainland race.

In the earliest times of man's occupancy, hunting pressure was apparently heavier on the Lower Keys than on the upper group. Hernando d'Escalante Fontaneda, the Spanish youth who was cast ashore on the keys in 1545 and lived among the savage Calusas for seventeen years, spoke in his *Memoirs* of "many deer" and mentioned the Indian settlement on the "Islands of Cuchiyaga," which is interpreted as meaning the Lower Keys. The botanist J. K. Small wrote, "On the lower Florida Keys, where game abounded, man left his mark... The upper Florida Keys did not offer a hunting-ground for the red man or much vegetation in the way of subsistence, so he passed them by —and their hammocks still remain to show his little interest in those islands." There are a few kitchen middens on Key Largo and Plantation Key, but these could have been merely casual camping places for Calusas on fishing expeditions. It is well known that the aborigines set fire to hammocks to facilitate their primitive means of hunting. As with the Everglade Keys, probably the larger of the Lower Keys were once covered with hardwood hammocks, similar to those that can still be seen on upper Key Largo and on Plantation Key. Successive fires set by Indian hunters destroyed the humus and exposed the honeycombed rock, and the elements did the rest. Hardwoods were finished. Only the relatively fireproof slash or Caribbean pine and the saw palmetto were able to thrive. It is in this habitat, surrounded by fringes of buttonwood and mangrove forest, that the remnants of the little Key Deer survive today.

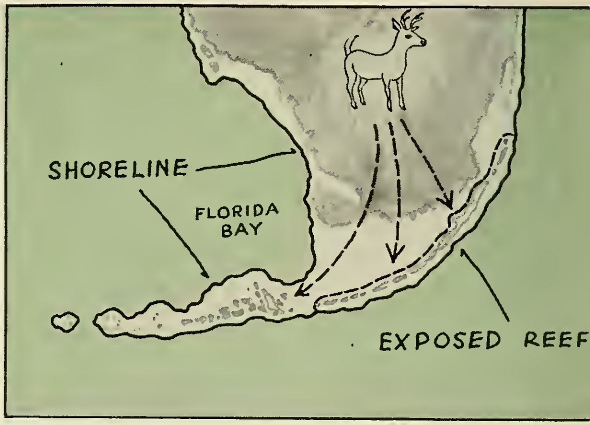
It has been suggested that these pygmy deer may have been introduced from the West Indies by settlers, but this appears doubtful. Columbus found small deer on San Salvador, but the native deer of Cuba is a larger animal than the Key Deer. And it cannot be overlooked that Fontaneda found deer numerous, apparently on the Lower Keys, in the mid-sixteenth century, and there were no white settlers until much later. It seems more likely that this diminutive race has survived here since early times, attaining their present stature and characteristics through the slow and devious processes of natural selection.

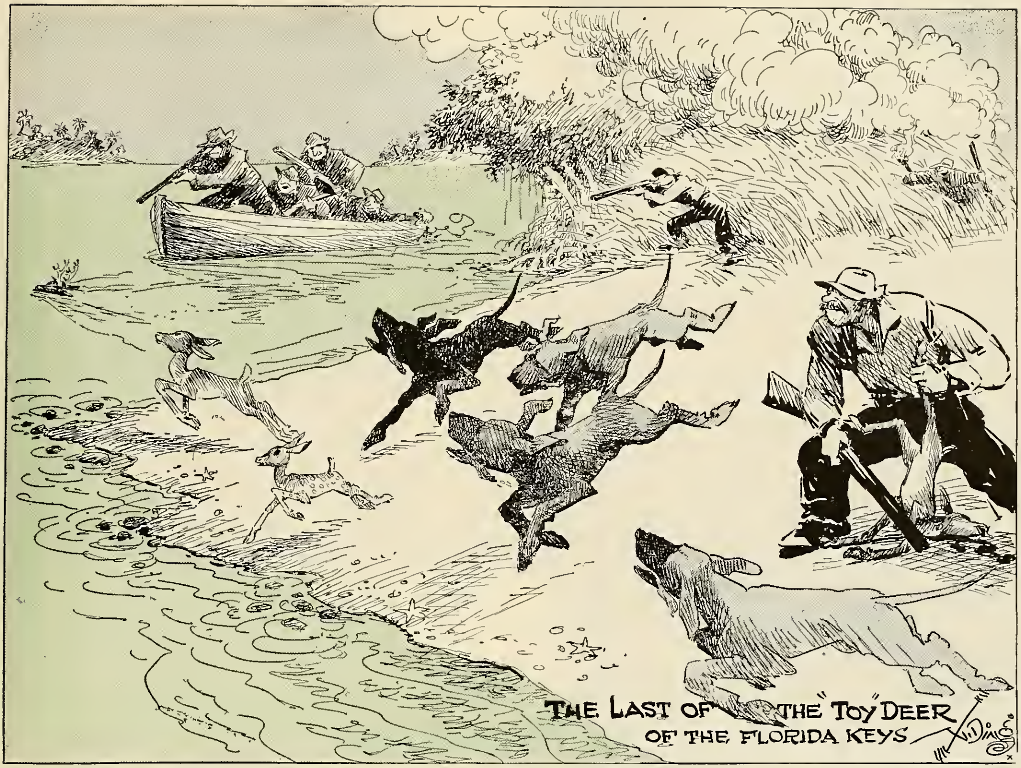
It also seems likely that these little animals would not have needed many special adjustments to live in this environment. Last summer Jack Watson found a great many water holes, fresh enough to drink from if you are not particular about a strong algal flavor, and fresh enough to support cattails and saw grass. There were also a surprising number of alligators—the only examples of this reptile south of the Everglades. (The salt-water habitat of Florida Bay and the Upper Keys is not the U. S. home of the alligator but of the American crocodile.) Evidently these tiny deer have survived in that



◀ DURING THE LAST or Peorian interglacial stage, water from the melting ice sheet raised the sea level so that Florida was awash as shown here

▼ LATER THE SEA LEVEL was drastically lowered during the Wisconsin glacial period as shown here. The sea fell perhaps 20 feet or more below the present level. Islands were joined, and the ancestors of the Key Deer were able to wander to almost any point in the keys




THE LAST OF THE TOY DEER OF THE FLORIDA KEYS
Ding

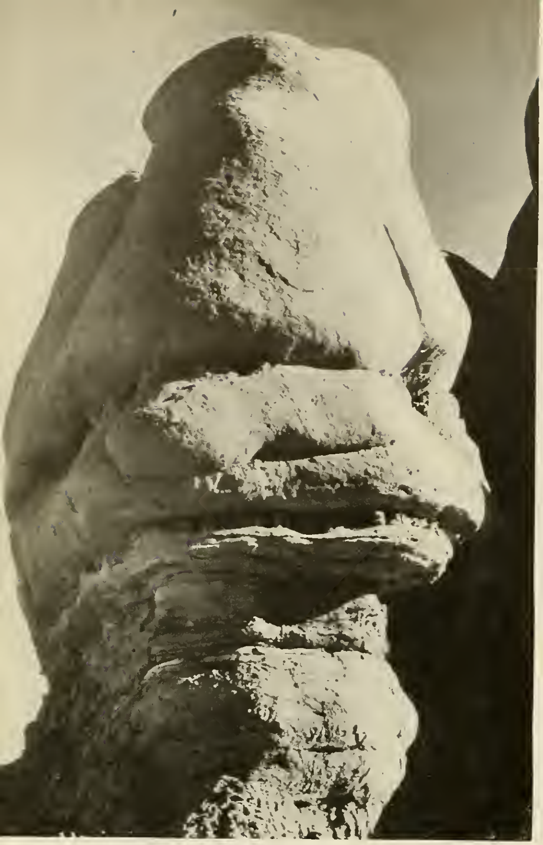
▲ A CHALLENGE to the conservation-minded public, drawn by the well-known cartoonist Ding Darling

environment for many thousands of years and continue to do so, even after the heedless shooting of the last two or three generations. That they are now in danger of extinction is not due to the inadequacy of their habitat. It is the result of shooting, running with dogs, losses on the Overseas Highway where a steady toll is taken by speeding cars, and the ever-present threats of fire and expanding real estate developments.

There may be no more than 30 of these toy deer alive today, but there is still a chance of saving them. Wide publicity of their plight, in recent months, has aroused public opinion in defense of the Key Deer. A concerted effort is now under way to set aside a suitable area as a federal refuge for this handsome, rare, and exceedingly interesting example of the native wildlife that is a valuable heritage of this land over which we have taken dominion.

Many organizations, agencies, and individuals have taken a hand in this endeavor. The U. S. Fish and Wildlife Service has provided effective warden patrol and is prepared to administer the proposed refuge. The Florida Game and Fresh Water Fish Commission, the Florida Wildlife Federation, the Monroe County Audubon Society, the National Audubon Society, and a number of others are also interested. Allen Corson, Conservation Editor of the *Miami Herald*, put on a campaign asking readers to express their views, and the response was overwhelmingly in favor of a federal refuge for the Key Deer. Congressman Charles E. Bennett of Jacksonville, during the last session of Congress, introduced a bill—H.R. 7524—the passage of which, along with companion bill S. 3286, introduced by Senator Claude Pepper, would authorize acquisition of needed lands within the Key Deer range. The House bill passed, but the Senate bill failed to survive committee consideration. It will be reintroduced in the 82nd Congress.

This tiny animal was a native of the Keys for some thousands of years before the arrival of the white man. It is a beautiful creature, with a gentle and appealing character. It is a living and attractive part of the scenery, more a part of Florida than the introduced flamingos at Hialeah Racetrack or the lush hotels that crowd Miami Beach. It belongs. If it is not provided for and protected from ignorant and irresponsible people who would slaughter the last member of its race, its passing will be on all our heads. Every conservationist should make a personal effort on behalf of this deserving and seriously threatened animal. Write your representatives in Congress urging them to support the passage of the bill to provide refuge for the Key Deer. Help save this vanishing American!



▲ WHEN YOU stand at the foot of this big fellow, you tend to feel a bit embarrassed beneath his stern and somewhat suspicious gaze

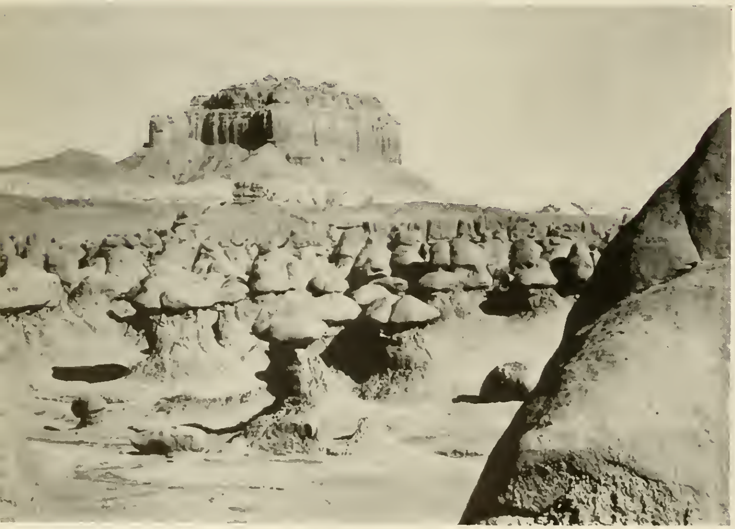
The VALLEY of the GOBLINS

Adventure beckoned from Back of Beyond and led the author over a difficult trail to this newly discovered wonder in Utah—a "real" fairyland, revealed to the public for the first time in these pictures

By HELEN C. MANZER

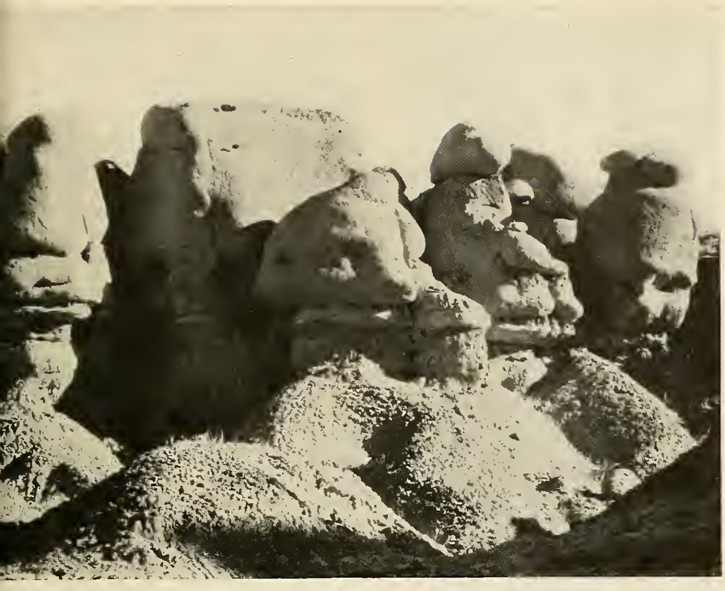
Photographs by the author

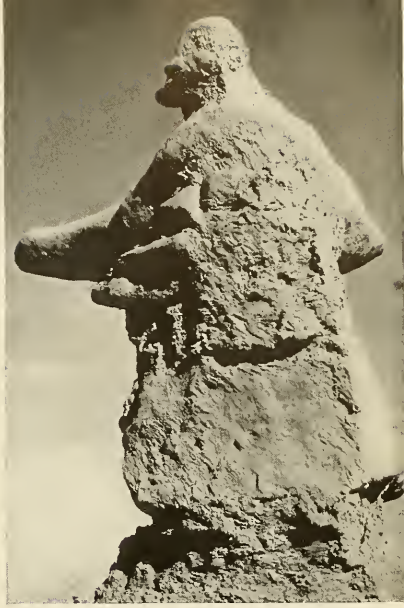
▼ WILD HORSE BUTTE, viewed across a small section of the Valley of the Goblins



SINCE the discovery of America, people have been exploring every nook and cranny of this great continent. It may come as a surprise to learn, therefore, that even yet there are places into which explorations have made little if any penetration. Such a place is the Valley of the Goblins. Have you ever heard of this valley before? If so, you are among a fortunate group of five or six persons in the United States, for the Valley of the Goblins appears on no map, is on no highway, and has no trails leading to it.

Our acquaintance with this valley came about through sheer accident. My husband and I love the West, especially Utah, and more particularly that great area in the southeastern part of Utah where there are no highways. If you look at a map, you will see that in this region. hundreds of square miles in extent, such roads as do exist are of dirt, and the would-be traveler is warned about flash floods and quicksand. And because he will be many miles from the nearest habitation, he is





▲ "FRIEND OR FOE?" this goblin seems to ask

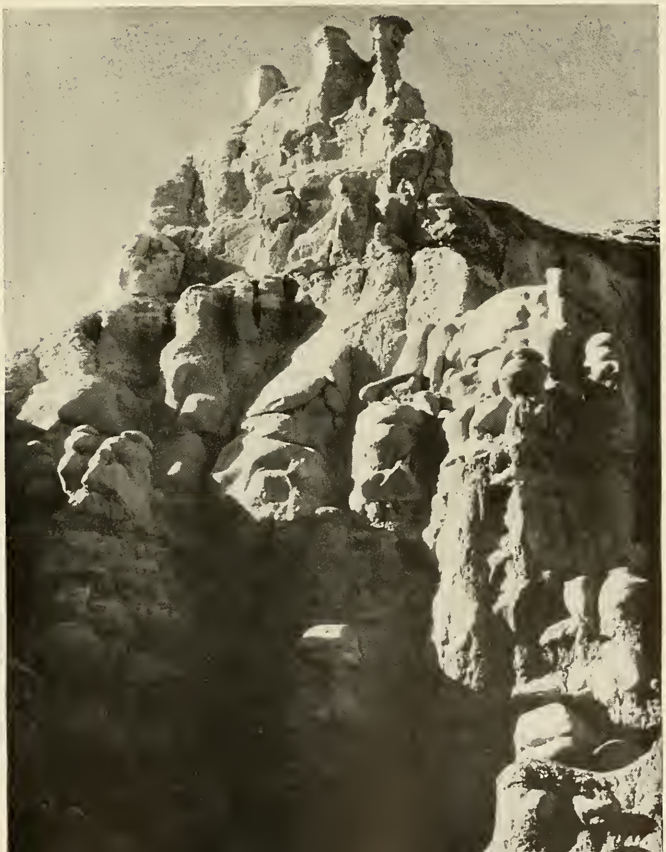
▲ THE MASSIVE FIGURES seem to take on animation as the oblique light emphasizes the frowns and smiles on their faces

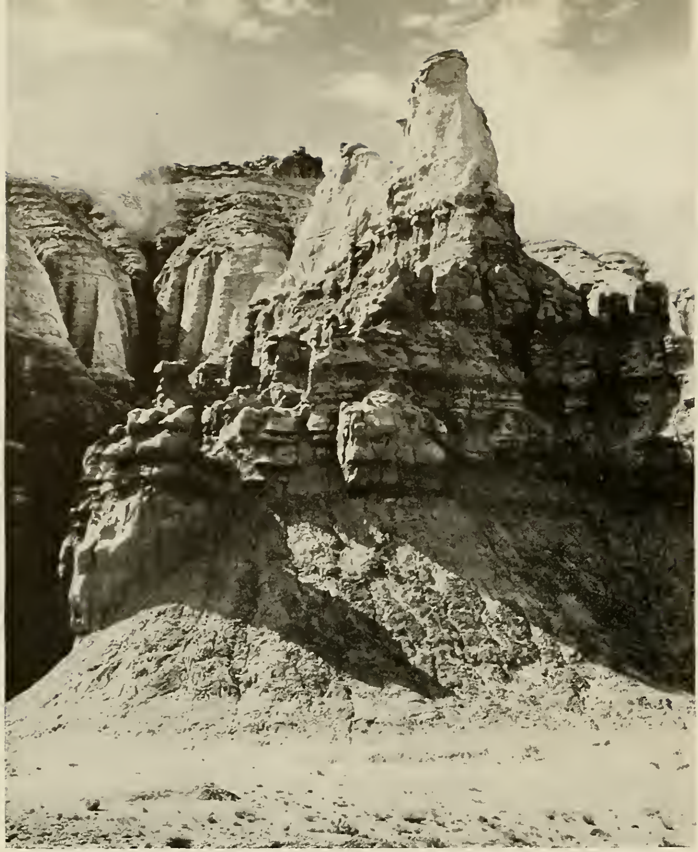
▼ FANTASTIC SHAPES resembling cathedrals and turreted castles have been carved in the lighter-colored sandstone at the upper rim of the valley

also urged to carry supplementary amounts of gasoline, water, and even food. Far from arousing fear, these descriptions and the implied hazards stimulated our imagination concerning the treasures of adventure and photography that must lie in that great area beyond the highway. We therefore set out by car to get as close as we could to this forbidding land.

It was during an overnight stop at the small, isolated town of Hanksville that we first heard mention of the Valley of the Goblins. We spent the evening in conversation with a group of local residents, and talk centered around the spectacular rocks in the region. One of the men in the party casually mentioned the Valley of the Goblins as a place where, he had heard, many fine specimens could be found. Much to our surprise, none of the other local residents in our party seemed concerned with the location of the valley, so the subject changed.

But the name "Valley of the Goblins" aroused our keenest curiosity.





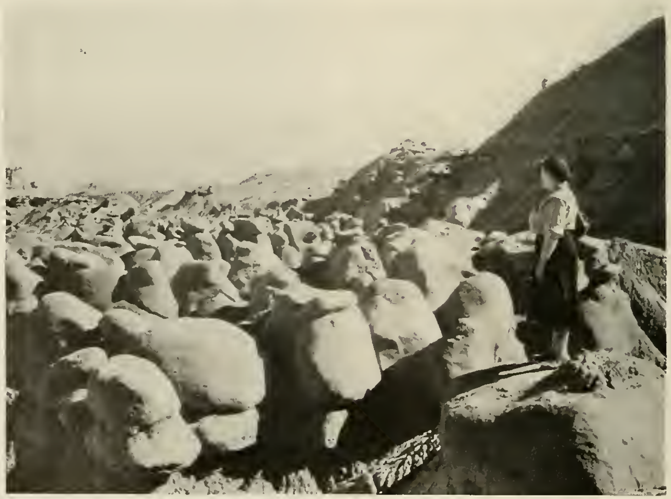
▲ THIS REPTILIAN GOBLIN might be called the King of the Valley. He seems to be looking over the entire "Kingdom" from his high throne

Where was it? And how might we get there? Later we put these questions to several residents, but most of them had never heard of the place. The man who had first mentioned the valley thought he could put us in touch with a neighbor who had been there many years before. Unfortunately, the neighbor was not at home, and we had all but abandoned the idea of visiting the valley when we fell into conversation with the couple at whose home we were to spend the night. Our host said it was his understanding that if we drove across the desert we might see, if the atmosphere was not too hazy, a great rock formation like a mesa rising high above flat country and situated many miles north of the road that runs between Hanksville and Green River. This great promontory, he said, is known locally as Wild Horse Butte. It was his opinion that we might find a dirt road leading to the base of the butte, at which point, if we turned left, we would come to the Valley of the Goblins.

Although this information was vague and we felt our chances of getting to the valley were meager, we set out the next morning in search of the strange goblins. Driving slowly eastward, we looked intently at every marking in the sand toward the north that could be interpreted as wheel tracks. After many false leads, we came to a large post, where the shallow, curving creases in the sand resembled wheel tracks more closely than the many irregularities we had already examined. After considerable deliberation, we decided to break with civilization, and we turned north out across the desert.

The surface seemed firm, and our tires did not sink as deeply into the sand as we had expected. Fortunately it was a clear, bright day with little haze. It was with real misgivings that we watched the road we had left disappear, and we wondered whether or not we would be able to retrace our course. Our apprehensions were not soothed by

▼ LOOKING down over the valley, one forgets the trials of the journey and stands fascinated by the weird sight



the sight of a rusty automobile body half buried in the sand. Some hours later we came upon the bleached and weathered skull of a hapless steer, who, perhaps like ourselves, had wandered too far from the beaten path.

These somber thoughts were abruptly ended by one of the most welcome spectacles that ever greeted our eyes. Looming high on the sky line, just as our host had predicted, was an immense rock formation: Wild Horse Butte! We wanted very much to go directly toward the butte but decided to continue on the firm ground we had been following. It was a wise decision, for our path eventually carried us into rugged country, seamed with steep ridges and broken with broad, deep crevasses. Repeatedly we had welcome reassurance that we were on the right path, for we encountered stretches of road that unmistakably had been cut in the side of steep banks.

➤ **The Turbaned Highwayman** hides his identity behind a kerchief over mouth and chin

➤ **This goblin** is complete with beak, ruff, and alert eyes

The going was difficult and slow. The day grew hot, and the desert seemed to extend interminably in all directions. Any accurate estimation of distance was impossible, but we did know that Wild Horse Butte was growing larger and that details in its precipitous sides were becoming more distinct. Soon we realized that most of our difficulties were behind and that the distance to the base of the butte was almost uninterrupted, undulating desert.

It was three o'clock in the afternoon when we arrived at the butte. I experienced a feeling of almost indescribable joy and of unreality, combined with a strange lapse of memory for the tortuous course over which we had come. Tired, but extremely happy, we rested a little at the base of the butte. Then, fortified with a light lunch and a drink of precious water, we set out on foot toward the Valley of the Goblins.

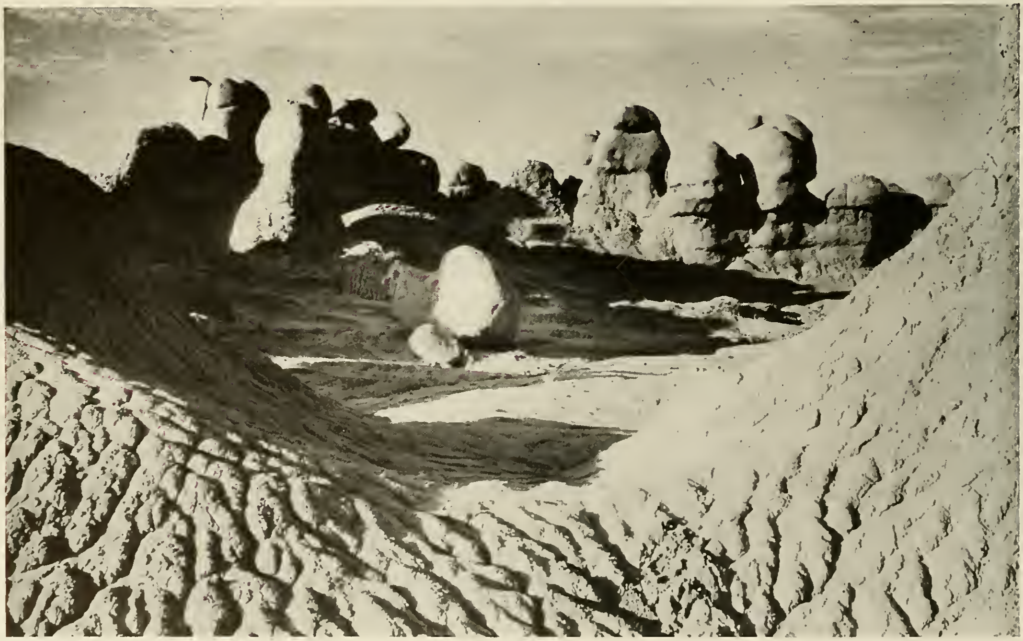
The sand was soft and deep, and I sank into it almost to my ankles. My haste to press forward caused me to slip backward at every stride. Soon, almost breathless, I was compelled to slow my gait to a more deliberate pace. Before long we came upon an area that was steadily rising and deeply gashed with many small, winding canyons. To get beyond these canyons, we were obliged to change our course frequently. As a result of our complete unfamiliarity with the terrain, we often found ourselves at an overlook surrounded on three sides with steep banks that descended abruptly to the narrow canyon bottoms. Determined to maintain a general course directly forward in spite of the canyons, we occasionally walked or slid down the sides and continued along the bottom as one might follow the dry bed of a winding stream. But again, we frequently faced a dead end and were obliged to retrace our steps.

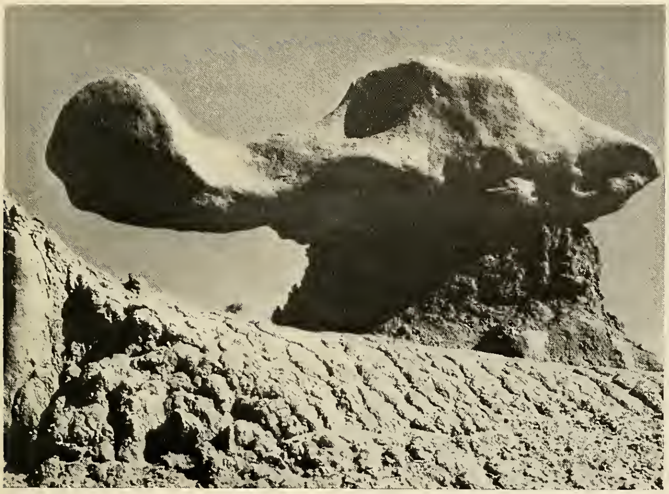
Despite the fatigue and frustrations of the journey, the trip was not without its pleasurable side. Here and there we came upon stretches of open, flat land on which rocks were scattered in great profusion and in a magnificent variety of shapes and colors. We were also impressed with the delicacy of patterning on the sides of most of the canyons. Countless heavy rains must have run down over these banks in a million little rivulets, converging, dividing, and converging again, as the water plunged toward the bottom. After it dried, the soft earth of the canyon walls was left with a lacy, interwoven design, broken only by our footsteps as we struggled to climb to the top of some ridge.

It was nearly five o'clock, and I had begun to wonder if we had correctly understood our host's directions. Were we, after all, going toward the valley? Most of the canyons were behind us, and in front rose the steepest upward ascent we had encountered. This slope was not too rough, and soon we found ourselves on the summit of a high plateau. To the north we could still see our landmark, Wild Horse Butte, while to the south—I could scarcely believe my eyes—lay the reward for all our wanderings: a vast assemblage of Goblins in their Valley!

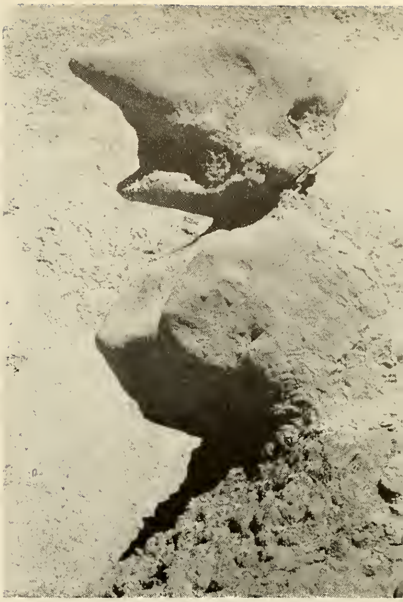
In the pale orange glow of a low sun there appeared in the foreground row upon row of short, plump goblins, many of them with twisted forelocks, upturned heads, and the amusing countenances of kewpie dolls. Farther back, the goblins were taller. Most of these appeared to be bareheaded; a few seemed to be wearing broad, flat

▼ **Reception Committee. It is easy to imagine that this group of stalwart goblins will admit only those with proper credentials**





▲ "Donald Duck," on a high dry ledge, is out of place, because waterless desert extends on all sides of him



▲ A goblin that resembles a chick sporting a large floppy beret

hats, which cast long shadows across the upper part of their foreheads; while others, with arms extended, were gesticulating to friends on the other side of the valley. In the distance, one side of the valley rose steeply to a jagged sky line. On this incline, as in an amphitheater, tiny goblins with round cherubic heads seemed to be giggling with amusement at the antics of their brothers, who were cavorting in the lower part of the valley. At first I felt we should pause and go no farther lest we interrupt the merrymaking of this festive occasion. But the sun was sinking lower, and it was most urgent that I get some pictures before darkness. We went down into the valley with camera and tripod, and I made portraits of several typical goblins before the light faded completely.

Footsore and weary, we retraced our course to the base of the butte, where we camped for the night. The early morning light of the next day, with different shadows and new angles, directed my attention to many of the goblins I had not noticed the afternoon before. By noon we were on our way back to Wild Horse Butte, thrilled by the richness of our reward and eager, upon returning to civilization, to share with others what we had seen in the Valley of the Goblins.

* * *

The valley is the result of the erosion of Navajo sandstone by water, wind, and frost. This sandstone is a mixture of soft, porous material in which are embedded in irregular strata harder portions that have been shaped into circular and elliptical forms. Because the softer material has been eroded rather rapidly, the harder, rounded forms remain on the tops of irregular columns which, to the visitor, take on the appearance of goblins. The goblin-like appearance of these grotesque forms is made still more convincing by the variety of interesting shadows that are cast in oblique light. The upper levels of Navajo sandstone are light, almost white, in color. Some of this whitish material appears at the upper rim of the valley, where it is rapidly being eroded into a vast array of fantastic shapes that resemble thrones, cathedrals, and spires. In the lower levels of the valley, where most of the goblins are to be found, the sandstone is red, orange, and yellow in color.

As the observer looks out over the Valley of the Goblins he is impressed by the endless variety of shapes. No two are alike. And as he changes the direction from which he views the valley, these shapes also appear to change. It is difficult, as mentioned before, to estimate distances accurately in this desert country, but I believe that the Valley of the Goblins is about two miles wide and four to five miles long.

The softness of the material and the ease with which the visitor can approach the goblins, once he has entered the valley, present the possibility that unthinking mischief-makers may deface or even destroy these remarkable forms. In order to preserve this area intact and free from commercialization, it would be most desirable that the Valley of the Goblins be designated a National Monument. Thus protected, the valley could in time be made accessible by roads and trails to the general public, who could then share the pleasures and thrills now enjoyed only by the hardy and venturesome.

Is the Guadalupe Fur Sea

Donald Rochlen photo

◂ Dr. George Bartholomew with a sea lion pup. It was while studying sea lions and elephant seals that he discovered the Guadalupe Fur Seal — the only authenticated survivor found in U. S. waters in this century

ONE day last summer, Dr. George Bartholomew, Assistant Professor of Zoology at the University of California at Los Angeles, was tramping along the southern tip of San Nicolas Island, the outermost of the Channel Islands off Southern California. He had been flown by the U. S. Navy to this sandy, barren spot—90 miles due west of the Los Angeles harbor—to take a census of the sea lion population and study elephant seals.

San Nicolas, about eight miles long and two to three miles wide, is a lonely place. The Navy maintains an airstrip there, but the island is dominated by howling winds, flying spray, and the cries of sea birds.

Suddenly—"Gr-r-r-r-r-r!"

From a sandstone shelf, cut up by tidal channels and potholes, Dr. Bartholomew heard a deep, roaring growl. Startled, he turned and saw a huge animal rising from a rocky depression. It was about 5½ feet long, weighed an estimated 300 pounds, and had a pointed, foxlike muzzle and thick neck. Long guard hairs stuck out from its completely dry coat, creating a soft, furry outline. The underfur was brown, and the guard hairs were tipped with yellowish gray—giving the animal a grizzled, almost silvery appearance.

This was neither a sea lion nor an elephant seal, Dr. Bartholomew mused. What was it?

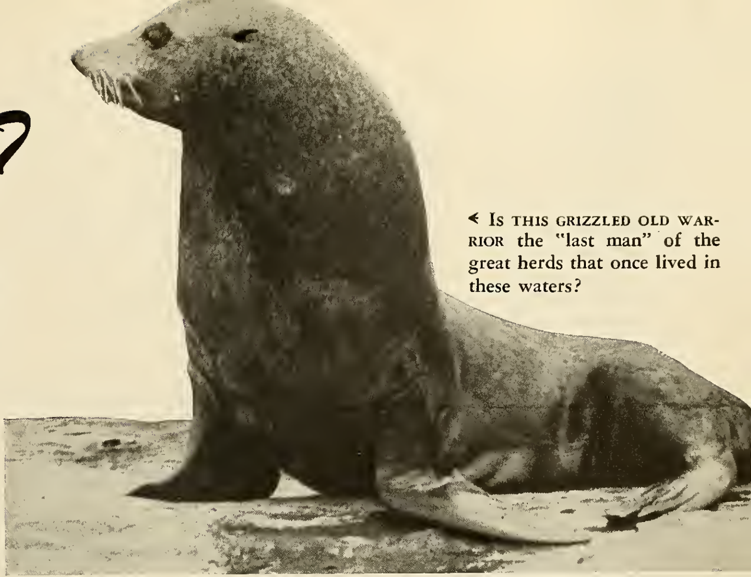
The animal made no precipitous dash toward the water as the sheeplike sea lions do when human beings approach. This old boy held his ground and growled steadily as the zoologist trained his binoculars on him. After about three minutes, the animal backed slowly into a small

Returning?

Considered extinct in recent years, this valuable relative of the Alaskan Fur Seal may be re-establishing itself on the islands off California

By

Andrew Hamilton



< Is this grizzled old warrior the "last man" of the great herds that once lived in these waters?

George Bartholomew photo

tidal channel and swam leisurely and silently away.

The thought hit Dr. Bartholomew like a thunderclap:

This was a Guadalupe Fur Seal—an animal once slaughtered in great numbers along the California and Mexican coast for its rich fur but in recent years considered as extinct as the dodo or the passenger pigeon.

The Guadalupe Fur Seal (*Arctocephalus townsendi*) is a cousin of the Alaskan Fur Seal (*Callorhinus alascanus*). When active on the West Coast, it lived and bred along a 1500-mile string of islands from the Farallones near San Francisco to Socorro Island below Baja California.

After the Danish-born Russian explorer Vitus Bering opened up the Pacific to whaling and sealing in 1741, men of many nations flocked to these waters to hunt seals, sea otters, and fur seals. The latter were prized for the prices they brought in world markets. The rich, heavy pelts of the fur seal made luxurious robes for Chinese mandarins. They were worn by fashionable ladies in St. Petersburg, London, and Paris, and they sold profitably in New York and Boston.

Scientific records on the Guadalupe fur seal's life history are sketchy. But if we can gauge its habits by present knowledge of its Alaskan relative, this is probably how the animal lived and bred: The fur seals were polygamous, and the old males, who probably weighed up to about 500 pounds, "hauled up" first at the breeding beaches. The bulls held certain areas on the beach, and as the females—only about one-fifth their weight—came ashore, they were appropriated by the nearest males. A single harem contained from 15 to 100 females, with 30 the average.

The young were born on shore. With uncanny skill, the females were able to find their "pups" among the thousands of dark, furry youngsters that romped and played on the beach. From the age of one to four, the fur seals were especially playful. They frolicked like a herd of porpoises. Their chief natural enemy was probably the killer whale, which followed them to the breeding beaches and haunted the rookeries.

But it was man, with his mania for profit, who reduced the great herds to virtual extinction. Hunters worked from "mother ships" in canoes and netted the animals by the hundreds. Even more effective, they located the rookeries and went ashore with clubs and beat the animals to death. This slaughter not only eliminated the males and pups but also the females, which were pregnant and would bear the following year.

From written records that have come down in the past 200 years, we know that it was chiefly the Russians and their Aleut hunters who wiped out the Guadalupe fur seal. They skimmed the cream before the American hunters even knew that this animal existed off the California and Mexican coast.

George Bancroft, the great California historian, wrote that "from 1812 to 1840 the Russians kept up an establishment on the Farallones [off San Francisco Bay] as well as at Fort Ross [about 50 miles to the north]. The object was to secure fur seals, 1200 to 1500 skins being taken annually." W. Robinson, who wrote *Life in California* in 1846, put the figure even higher. He says that in some years the Russians took as many as 80,000 skins.

The log of the "Port Au Prince," a whaler that sailed from England in 1805, reported that 8338 fur seals were killed in a period of 19 days around islands off Baja California. The log of the ship "Dromio," out of Boston, shows that the crew arrived at Socorro Island in 1808 and took 3000 seals in two weeks.

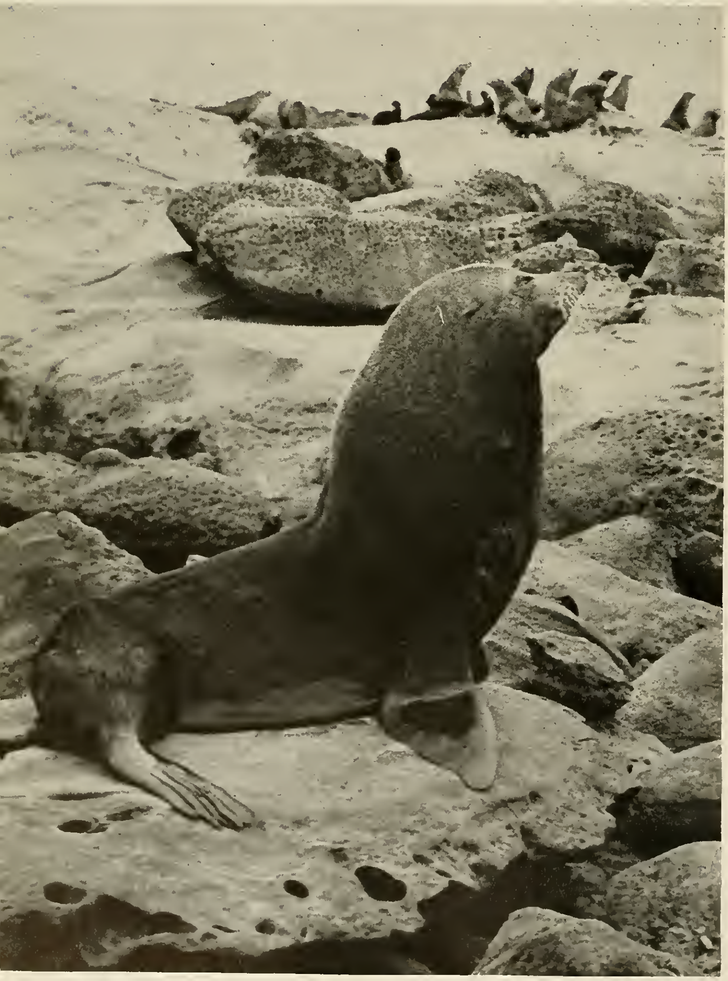
The slaughter must have been terrific, for as the nineteenth century neared its end, the Guadalupe fur seals became extremely scarce. Dr. Charles Townsend and A. W. Anthony visited Guadalupe Island in 1892 and found that the herds that once existed there had nearly vanished. They located the great polished rocks at the west side of the island which, at one time, were said to have accommodated 30,000 fur seals. They found the stone huts that served as shelter for the Russians and as storehouses for the hides.

But even then, 59 years ago, the fur seals that took their name from the island of Guadalupe seem to have been doomed. The only evidence that they had once existed in this area were seven animals seen swimming in the water and four broken skulls found on shore. The latter served to identify a new species, *Arctocephalus townsendi,* which had not previously been scientifically classified.

In 1928, however, a San Diego fisherman by the name of William E. Clover captured two Guadalupe fur seal males and reported about "60 animals, bulls, cows and pups" on Guadalupe Island. Several scientific expeditions were sent out to try to capture additional specimens, but the herd was never found. Clover's two males were placed in the San Diego Zoo, where they lived for about a year.

▼ **The Guadalupe Fur Seal** is distinguished by its brown coat with yellowish-gray guard hairs, its pointed foxlike snout, and its massive neck

George Bartholomew photo

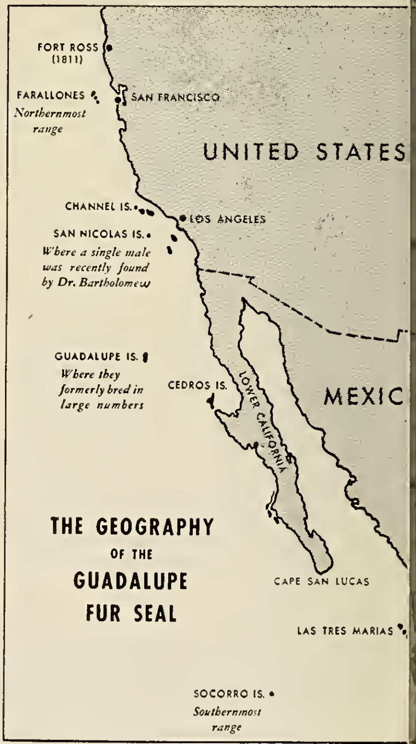


It is little wonder, therefore, that Dr. Bartholomew was astonished when he saw the big male on San Nicolas Island. When he returned to the University of California at Los Angeles, his colleagues listened with respect, but he could discern overtones of disbelief in the way they questioned him.

"Next time I see a Guadalupe, I'll bring him back alive—on a roll of film," he vowed.

Within a month, Dr. Bartholomew was back on San Nicolas, this time with a companion, William G. Reeder. The first day, they spent seven hours searching the rugged terrain without finding a sign of their quarry.

At 4:30 in the afternoon, when they'd just about decided to call it quits, they spotted the animal asleep at the base of a 10-foot terrace, about 125 feet from the water. The fur seal had adopted a posture often used by sleeping sea lions. It lay flat on its belly with its neck stuck out, its rear flippers pointed back-


FORT ROSS (1811)
FARALLONES
Northernmost range
SAN FRANCISCO
UNITED STATES
CHANNEL IS.
LOS ANGELES
SAN NICOLAS IS.
Where a single male was recently found by Dr. Bartholomew
GUADALUPE IS.
Where they formerly bred in large numbers
CEDROS IS.
LOWER CALIFORNIA
MEXIC
THE GEOGRAPHY OF THE GUADALUPE FUR SEAL
CAPE SAN LUCAS
LAS TRES MARIAS
SOCORRO IS.
Southernmost range

Donald Rochlen photo

▲ **William G. Reeder** holds a stop watch and Dr. George Bartholomew holds a stethoscope while both wish someone would hold the elephant seal long enough for them to count its heartbeats. The rate proved to be about one per minute

ward, and its front flippers pressed flat against its side.

"There's the Guadalupe fur seal I saw last month—or his twin brother," Dr. Bartholomew whispered to Reeder.

They crawled to the edge of the terrace. As Dr. Bartholomew focused his camera, the fur seal turned its head and growled. Since the animal showed no signs of fright, the zoologist stood up in full view and took photographs from about 20 feet.

The two men dropped down to the level of the ledge and walked slowly toward the fur seal for a better picture in the fading light. When they were about 15 feet away, the animal charged and chased them for 40 feet. Then it "lolloped" down to the water, swam out to a rock, crawled up on it, and shook itself like a dog.

A month later, when Dr. Bartholomew was completing his sea lion census on San Nicolas, he saw the Guadalupe fur seal a third time—or, to be scientifically correct, he saw either a second or third animal of the same species.

This time Dr. Bartholomew and Reeder were accompanied by Kenneth Stager of the Los Angeles Museum. Again they discovered the animal asleep near the spot where it had been seen the second time. This time it was lying on its back, with rear flippers extended and front flippers crossed over its belly.

Following the shelter of some large rocks, the three men were able to get within twelve feet of the animal. As shutters clicked, it rolled

▼ **Slipping** a thermometer under an elephant seal's flipper, Dr. Bartholomew and William Reeder take the animal's temperature. They found it to be about 95 degrees

over with a growl and faced its two-legged enemies. For 10 minutes the scientists were able to photograph and observe from distances of 30 to 10 feet. Occasionally the beast would charge one of the men, but it did not retreat. Finally tiring of the sport, the fur seal walked slowly and majestically down to the water, stood motionless for a moment, and then plunged in. It was a dramatic exit, for it did not surface within the vision of the three men on shore.

The pattern of vocalization of the Guadalupe fur seal is considerably different from the California Sea Lion, which inhabits the same area. Whereas the latter has a shrill, penetrating bark, the fur seal has a "throaty, muffled sound with sometimes almost the tone of a steamboat whistle." Dr. Bartholomew reports that he has heard three distinct types of sound uttered by the Guadalupe fur seal on San Nicolas Island: (1) a deep roaring sound, made when charging, like the sound uttered by lions and tigers, (2) a deep, hoarse growl, ascending to a querulous rasping tenor note, made when standing still, and (3) occasionally a deep, barking cough.

After observing and photographing the Guadalupe fur seal, Dr. Bartholomew found himself in the dilemma of a whodunit detective who has rounded up all the clues and suspects. All he had to do was to figure out the right answer.

Could the San Nicolas Island fur seal have been an Alaskan Fur Seal that strayed too far south? Decidedly not. Photographs taken by Dr. Bartholomew were compared with those taken of the San Diego Zoo captives before they died in 1929. The nature of the coat, the elongated snout, the low forehead, the slope of the antedorsal skull all proved that this was a genuine Guadalupe fur seal—not a northern carpetbagger.

Was the fur seal on San Nicolas Island a stray from an undiscovered herd that still existed on Guadalupe Island, 400 miles south? This seemed like a good lead, and Dr. Bartholomew investigated it thoroughly. Aboard the "Orca," research vessel for the Joseph W. Sefton Foundation, he and Dr. Carl Hubbs of the Scripps Institution of Oceanography spent two weeks at Guadalupe Island. They found not one single sign or shred of evidence that a herd of fur seals existed there in recent years.

Eliminating the two previous possibilities, was the single Guadalupe fur seal that was seen on San Nicolas Island the "last man" of the great herds that once swam so proudly in these waters off the California coast? Dr. Bartholomew doesn't think so. He believes that somewhere in the rocky fastnesses and lonely coves of Southern California's Channel Islands there may still be a small breeding colony, with virile males and compatible females, to perpetuate the species.

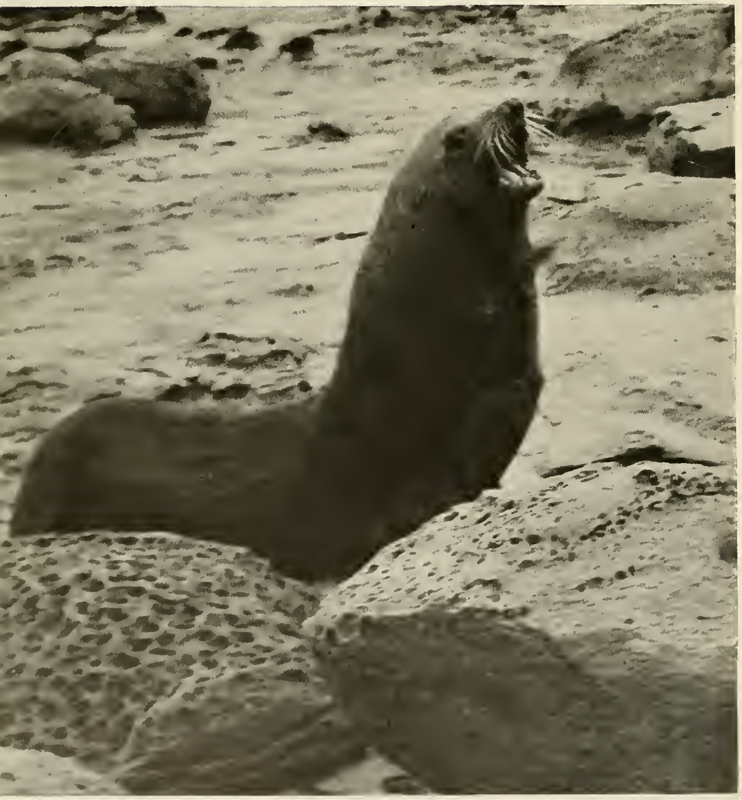
He says: "The coast of San Nicolas is extensively dissected, and there are along it a number of sea caves that are inaccessible from shore. It is entirely possible that there were in the area fur seals other than the one (or two, or three) reported recently.

"The animal (or animals) seen on San Nicolas Island represents the second authenticated record of a living Guadalupe fur seal during the present century, and the first verifiable observation of a living representative of this species in United States waters. It shows that the Guadalupe fur seal is not yet extinct; and it strongly implies that there still exists at some unknown spot a breeding colony of these animals."

The grizzled old warrior that Dr. Bartholomew found on San Nicolas may be evidence that this supposedly extinct animal is actually making a comeback.

▼ **Fur seals** frequent rocky island shores like this, indented with potholes and tidal channels

George Bartholomew photo



SKY ISLANDS OF ARIZONA

Continued from page 63

pecting dogs that happen to be passing by. It is true that a coati will defend itself against an attacking dog—and who can blame it?—but in general they are harmless, interesting animals, which are often tamed as pets in Mexico.

A large band of chulas inhabits the pine forests of the Reef, high up in the Huachuca Mountains. One time I encountered them crossing the Reef Road. I stopped the jeep and waited fully three minutes while scores of coatis—big ones, medium-sized, and troops of babies little larger than kittens—scurried by. Again, at least 50 coatis suddenly dropped from tree branches and slithered down pine trunks all around me. They made off through the woods with a sound in the dead leaves like a heavy downpour of rain. In neither case did the animals appear particularly frightened.

Arizona's sky islands are easy to explore. No long sea voyage is necessary, nor need you go on an extended safari into the wilderness. The higher ranges are within detached sections of Coronado and Crook national forests. Numerous improved automobile campgrounds are maintained by the United States Forest Service, while good foot and horse trails traverse the high country and lead up to lofty ridges commanding sweeping panoramas over thousands of square miles of desert, valleys, hills, and mountains.

In fact, most of the ranges can be visited behind your own steering wheel. The 8000-foot crest of the Pinal Mountains is reached by a good road from Globe, and a 30-mile paved highway climbs from Tucson to the ridge of the Santa Catalinas. Canyon roads penetrate the Santa Rita and Huachuca Mountains, from which trails ascend to the highest summits; and the extensive forest wilderness of the Chiricahuas is breached in several places. The aloof Rincon Mountains alone are still accessible only by pack trail.

Highest and most spectacular road is the Swift Trail, which winds up the gigantic slopes of the Pinaleno Mountains to the broad shoulders of Mount Graham, 10,713 feet above sea level. This well-engineered, graded highway is 36 miles long and takes you 7108 feet skyward through all the climatic and vegetational zones you would encounter on a 2200-mile trip from northern Mexico to Hudson Bay. The changes are so rapid that you have a feeling of riding a rocket northward at 1000 miles an hour.

One day last summer—June 30 to be exact—a companion and I made the incredible jump from sweltering desert to Mount Graham's summit snows in three hours and a half. Starting from Safford, 2930 feet elevation, at 9:15 A.M. in a temperature of 86 degrees F., we were dressed in shorts and light shirts. At the junction of the highway with the Swift Trail, seven miles south, we hung a maximum recording thermometer in the shade of a gnarled old ironwood tree. A sparse growth of yucca, cactus, ocotillo, creosote bush, and other stunted desert shrubs characterize the area as the Lower Sonoran Zone. This is the hottest and driest life zone in western North America, and it is named after the state of Sonora in northern Mexico where such deserts are common. Temperatures here in summer rise to 110 to 115 degrees F., and the average yearly rainfall is but 8 to 10 inches.

Five minutes later the car swung into the first loop on its climb of the kaleidoscopic climate ladder into the sky. The desert soon gave way to grassy hillsides dotted with oaks, which increased with altitude to open woodlands. Here was the next zone, the Upper Sonoran, extending from 4500 to 6500 feet. This has one of the pleasantest year-round climates in the United States, and there are extensive areas of this zone in southeastern Arizona. Summer temperatures seldom go above 100 degrees F., and winter cold is tempered by a warm southern sun. Precipitation ranges from 12 to 20 inches, with the heaviest rains falling in July and August.

Stands of Chihuahua pines and increasingly heavy growth of ponderosa pines announced that we

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had left the Upper Sonoran and set foot on the next rung of the climate ladder, the Transition Zone. The final climb to the ridge was made in a series of switchbacks through a dark green aisle of white firs, Douglas firs, oaks, alders, and maples. Between the trees we caught fleeting glimpses of the shining desert more than a mile below us.

At 10:45 A.M. we parked the car at 9100 feet and took the 4-mile Mount Graham trail on foot. We had reached the Canadian Zone with a climate resembling northern Maine or Minnesota. Here were spiry alpine firs, spruce, and quaking aspen, fern-banked streams and green meadows spread with wildflowers. For this high oasis above the desert has an annual precipitation of 40 inches—equal to that of New York City. The temperature as we started up the trail was a chilly 64 degrees F., and we had donned trousers and jackets.

As we hiked up through the deep evergreen woods past majestic Douglas firs seven feet in diameter, we might have been in Oregon or British Columbia rather than within a few miles of the Mexican border. Friendly chicadees, chattering squirrels, and the sight of a bear lumbering off up the mountainside heightened the effect of being in the North Woods.

The first snow patches were encountered at 11:25 A.M., and from then on we labored over a firm, frozen pack from a foot to seven feet deep. We topped the great dome of Mount Graham at 12:45 P.M., and on went gloves and extra sweaters. A bleak wind whistled through the stunted spruces, and scudding clouds blotted out the sun. Our thermometer read 52 degrees F.

Shaking with cold, we looked back down the climate ladder to the desert shimmering in heat waves 8000 feet below. The high temperature for the day in the shade of our ironwood tree down there was 108 degrees F.—a difference of 56 degrees F. in an airline distance of ten miles! So, while we experienced weather at the summit similar to that of the Alaskan coast, we could survey five of the seven life zones of western North America on the plunging mountain slopes beneath us. Only the two ends of the ladder were missing: its topmost rung, the frigid Arctic-Alpine Zone; and at the bottom, the steaming, humid, Tropical Zone, found along the coasts of southern Mexico.

But the seasons, too, bring amazing changes and variety to these mountains. Whether it be the high-piled, white thunderclouds of summer, deep winter snows in the quiet forests, or the flaming maples and golden aspens of autumn, there are always new wonders and beauties waiting to be discovered on the soaring Sky Islands of Arizona. There is also at all seasons the peace and satisfaction best found in nature's wildest places.

LETTERS

Continued from page 50

in the sources as to the direction. Some state that the immigrants come from the east, others from the west. Heyerdahl emphasizes the importance of this tradition. However, it cannot refer to Peruvians, since the migrants came in two large double canoes typical of the Polynesians and not on Peruvian rafts. It can only refer to Polynesians returning from a trip to America. Such recent east-to-west reflex migrations from Polynesia are well known in eastern Melanesia, as for instance in Fiji, where they can be clearly distinguished from the west-to-east migrations of the early Polynesians.

Also, the facts of physical anthropology contradict an American origin for the Polynesians. Mongoloid features are very strong in the western Pacific and decrease markedly from west to east. Had the Polynesians come from America, one would expect such features to be about as strong in eastern Polynesia as they are in the South American Indians.

When Heyerdahl identifies the Polynesian god Tiki with the Peruvian hero Kon Tiki, the unprepared reader may easily be taken off guard. Kon Tiki's full name is Con-Tici-Wiracocha, Con-Tici being a title. To take part of that title, the word Tici, and equate it with the Polynesian name Tiki is the more arbitrary, since there is not sufficient evidence in the traditions to justify this equation.

Heyerdahl's merit lies not only in his demonstration of the feasibility of a raft voyage across the Pacific, but also in the fact that he has added a few more traits to the long list of already well-known similarities between America, the Pacific, and the Old World. One may even grant him that some of these common elements might have been brought to Polynesia by raft voyages from America. Whereas this enriches our knowledge of the ways of possible trans-Pacific culture contact, it does not, however, shake the well-established belief of most authorities that the Polynesians originated in Asia.

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Inquire P. E. LEWIS,
Oregon Audubon Society, Tigard, Ore.

SIRS: ***A Slow Boat***

I was very much interested in your January issue.

In the first place, I believe the explanation of the Flying Saucers is the best that I have ever seen.

Strangely enough, I have seen these things go by while in an airplane but, of course, always traveling in the opposite direction. I was perfectly aware of what they were, however, and have never seen these strands of silk in the perfect shapes with which your artist has illustrated them.

Also, I was much interested in the Feather Falls in California and am sending the issue on out to a friend of mine in San Francisco.

Mainly, however, I want you to tell Dr. Eugenie Clark that I am deeply in love with her and quite willing to accompany her on any trips she might be making to the South Seas.

(Name withheld)

Dr. Eugenie Clark has already left on another long expedition—to a remote section on the shores of the Red Sea—and has promised NATURAL HISTORY further accounts of her extraordinary travels.—ED.

March **NATURAL HISTORY** 1951

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LETTERS

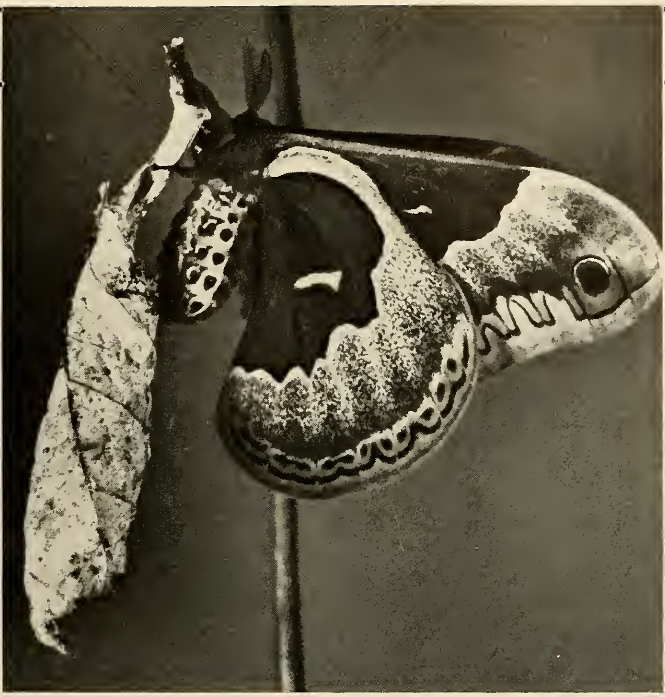
An Uninvited Guest

SIRS:

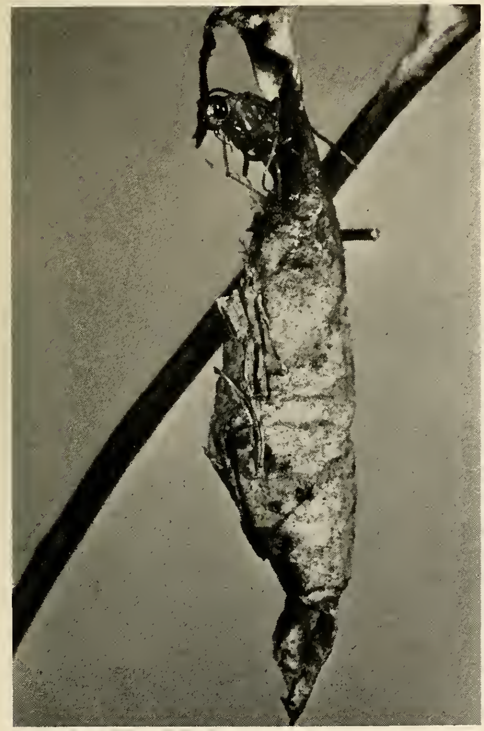
For several seasons I gathered Promethea moth cocoons in the hope of photographing the emergence of the adult moth. As many readers know, the large green caterpillars that transform into the Promethea moth, *Callosamia promethea*, are most commonly found during the summer, feeding on the leaves of wild cherry, sweet gum, lilac, and a few other shrubs. When full grown, they build this cocoon within a rolled leaf that has been firmly attached to the twig by strong silk threads.

For two years I missed every emergence. Then one evening I came into my study and observed a head just sticking out of the cocoon. Thinking to myself, "This is it," I hastily put the twig on the desk and brought my camera and lights into action for a close-up. But as the insect emerged, it became evident that a surprise was in store for me.

It was no Promethea that emerged from my cocoon. There are several kinds of parasites that lay their eggs in the caterpillar of the Promethea and related moths. Among the common parasites are

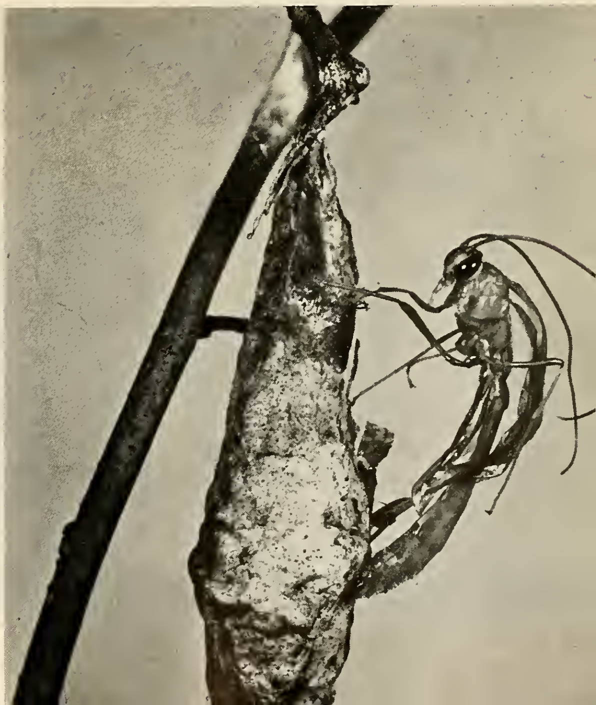


▲ ORDINARILY, a Promethea moth would have emerged from the cocoon, as shown here



◀ BUT a curious looking creature stuck its head out

▼ A parasitic wasp belonging to the large family known as "ichneumon flies" emerged from the Promethea cocoon



species of *Ophion*, parasitic moths belonging to a large family known as ichneumon flies. It is one of these that is shown coming out of my Promethea cocoon. I am told that this may be the first time that this event has been photographed.

J. R. Swain

Middletown, Conn.

Sirs:

Thanks for your inspiring publication; it suits our temperament. The excellent printing, splendid illustrations, and fascinating articles in Natural History make fine fare for winter evenings in the hill country.

Most magazines are short-lived in our household, but it looks as if Natural History will remain with us for many years.

The November cover of the Prothonotary Warbler, with the coloring enhanced by the bird's shadow, is an example of arresting beauty.

In a world racing mad against time, Natural History is refreshing in its timelessness . . .

Howard T. Lakey

Newburgh, N. Y.

Stefansson on Snowhouses

Sirs:

In your good remarks on the good photographs of the Right Reverend D. B. Marsh, Bishop of the Arctic for the Anglican Church of Canada, you say in the February Natural History:

". . . Bishop Marsh informs us that these Padlemiut Eskimos live in temperatures sometimes as low as 40 degrees below zero inside the snow hut."

The "temperature sometimes as low as 40 degrees below zero" seems to require interpretation. Having lived in unheated snowhouses at the outdoor temperatures you mention, and having found that the body heat of the occupants normally brings the interior temperatures well above Fahrenheit zero, I have thought (not doubting the Bishop's verbal accuracy) that there would have to be one of five interpretations, namely that he is talking of (1) a house just after it has been built, when the temperature of the snow blocks themselves is the same as that out-of-doors and will rise only slowly, (2) a house that has a white-man type door in the wall instead of in the floor, not allowing for gravity control of the air, (3) a house that is white-man style in the sense of being so large in relation to the number of occupants that it is difficult to heat, (4) that he placed his thermometer too near the floor, or (5) that, like many brought up in England, he speaks in terms of "below freezing" which we readily confuse with "below zero."

The best statement I know of for unheated snowhouses in the general region described by Bishop Marsh is in David T. Hanbury's *Sport and Travel in the Northland of Canada.* The snowhouses Hanbury speaks of may even have been the proportionately large ones he had built for himself. Explaining that he took the temperatures of different iglus all through the winter he says, "For the first day of its occupation, a newly-built iglu remains cold. When the thermometer outside registers any temperature from −20° to −50° Fahr., the temperature inside is only about 10° higher; sometimes not so much. Next day, however, when the iglu has settled somewhat, and more snow has been thrown on the roof, the temperature is brought to about 24° or 26° (i.e., 6° or 8° of frost), and there it remains, the temperature outside having little or no effect on that inside."

From the snowhouse experience of the Boy Scouts at Saranac Lake and of Dartmouth students at Hanover, as well as from my own experience, I know that when a house is built of good snow and occupied by four or more persons, and when it is no larger than required by Eskimo standards, then one built in the evening and slept in will be at least 40 degrees warmer in the morning than the temperature out-of-doors, if the weather is very cold. The temperatures I have in mind would be registered by a Fahrenheit

continued on page 143

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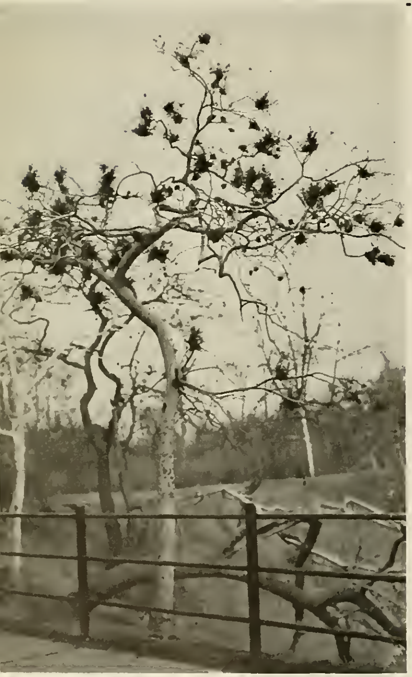


Witches'-brooms

Sirs:

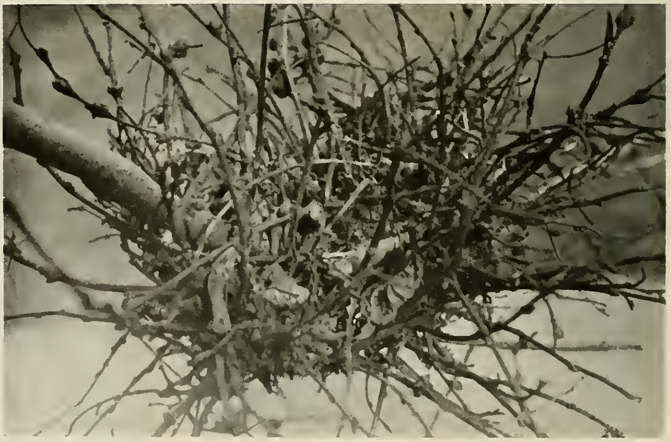
I am wondering whether your readers are acquainted with Witches'-brooms. Fungus or insects are believed to cause these growths, which make their appearance as tufts of twigs on the ends of many of the branches.

Dorothy Freas

Woodhaven, N. Y.

◄ HAVE YOU SEEN THEM . . .

▼ CLOSE UP?



NATURAL HISTORY

The Magazine of the American Museum of Natural History

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VOLUME LX—NO. 3 **MARCH, 1951**

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From a color photograph by Jack Breed

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You will find Natural History *Magazine indexed in* Reader's Guide to Periodical Literature *in your library*

THE COVER THIS MONTH

The Indians of our Southwest have long inspired photographers, and one of the most photogenic is Ada-Ki-Yazzi, a medicine man of the Navajo tribe. On this month's cover you see him as he posed for Jack Breed with his favorite white pony. They are near Mitten Butte in Monument Valley on the Utah-Arizona border.

Ada-Ki-Yazzi, whose name means "Little Gambler" in English, is one of the 62,000 Navajos struggling to keep alive in their arid 25,000-square-mile reservation. Sheep and goats are their prime means of livelihood, supplying them with food, clothing, and the wool with which to weave their famous Navajo rugs.

Our Cover Navajo keeps his large family in a group of earth-covered lodges, or hogans, near the base of Train Rock at the northern edge of Monument Valley. When this picture was taken, Ada-Ki-Yazzi had just officiated at a four-day sand-painting ritual in which he served as the Chief Shaman. In marked contrast to this brief religious interlude, he returned the next day to his current job as caretaker on a permanent Hollywood movie set that has been erected in the valley to provide the "local town" in various Westerns!

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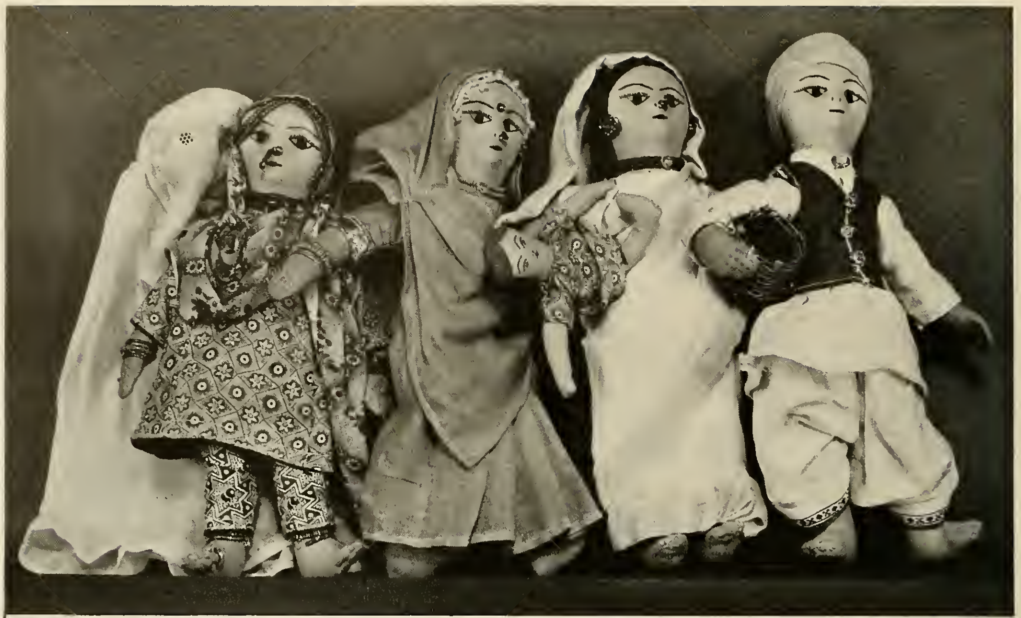

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YOUR NEW BOOKS

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Indians of Peru • Yosemite • Ruxton

DE RE METALLICA

------ by Georgius Agricola; translated by Herbert C. Hoover and Lou Henry Hoover

Dover Press, $10.00
638 pp., 280 illusts.

IT is a little late, almost 400 years, to write a review of the substance of this work, a book which led its field for nearly 200 years. In some respects, Agricola foreshadowed many modern theories of geology, both as to the erosional origin of mountains and to the subsequent deposition of ore veins in older rocks. The chief interest in the work today is threefold, but no one should expect to learn anything new from it since there are more modern books for the student of modern mining.

The identity of the translators naturally evokes considerable interest; few people today realize that former President Hoover was such a scholar. Probably he has not had the leisure for such a time-consuming job since he entered public life. The first printing of the work was an edition of limited size published in facsimile style in London in 1912. For many years now, this beautifully printed work has been a collector's item, often costing as much as the first Latin edition of 1556.

In recent years several ancient works have been translated and reissued for the benefit of a new generation of students. This reprinting by the Dover Press is very welcome, since it has made another classic, the finest of all mining books, available at a moderate cost.

To many people, the reappearance of this translation—the only one in English—will be of interest because of the new light it gives on Mr. Hoover. The careful reproduction of the 1912 edition, with its clear woodcuts from the original and its imitation of the arrangement of the 1556 edition, gives the modern reader something of the feeling of the old book. It also impresses us again, as do all of these imitation facsimiles, with the bookmaking craft of the early printers, who were prouder of their products than of their productivity.

The appendices and the index added by the translators point out the importance of the work, its place in the history of mining literature and in the advancement of science generally, and, incidentally, the tremendous amount of work and collateral reading exhibited by the Hoovers. All of the work, slightly reduced in size from the original so that it now is a quarto volume, is taken from the 1912 printing, page for page. The woodcuts are just as sharp, the type just as clear. The bibliophile, the student of mining or chemistry, and admirers of Mr. Hoover's many talents should all find this a book well worth adding to their libraries.

F. H. POUGH

THE SMITHSONIAN—AMERICA'S TREASURE HOUSE

---- by Webster Prentiss True

Sheridan House, $3.50, 306 pp.

THE Smithsonian Institution is quite unlike any other public institution in the world. Made possible in the beginning by a bequest from James Smithson, an Englishman who had never been in the United States, it has grown through government support and donations from individuals into a vast aggregation of ten bureaus which deal with many aspects of natural history and art. This growth has taken place over a span of more than 100 years. The United States National Museum is one of the best known of these bureaus, and it is much the largest.

Mr. True relates in an interesting fashion how this expansion, from the original Smithsonian Building, took place. The will of Smithson specified "an establishment for the increase and diffusion of knowledge among men." This broad base for administration of the legacy was extremely fortunate both in its acceptability to the Government of the United States and as a stimulating philosophy for future growth. The story of the Englishman who made this friendly international gesture, and the steps necessary to implement the bequest, are an entertaining part of the book.

In the early years natural history had many unexplored frontiers. It was an advantage for the Smithsonian to start from scratch, and the wealth of accessions that began to accrue called for expansion to keep abreast of progress. Out of this has grown the great physical plant with its administrative and scientific staff, which justifies the subtitle *America's Treasure House.*

Today the world has shrunk in more ways than one. Highways and cities occupy the unexplored remoteness of a century ago; the ruthlessness of man has wiped many natural features from the face of the earth. But better understanding has opened new lines of research in natural history, and future prospects shift the emphasis from accession to use. The Smithsonian occupies a strong position because it has acquired so much material under the more favorable circumstances of the past and has the trained staff to guard and use it for future generations.

HAROLD E. ANTHONY

WILD ANIMALS IN BRITAIN

-------- by Oliver G. Pike

Macmillan and Co., London, $3.75
226 pp., 87 illusts.

". . . There is no greater thrill to a nature lover than to feel the tiny soft imprint of a small bird's foot on an outstretched hand, or to see a wild mammal emerge from its lair and fearlessly approach him." So writes Oliver G. Pike in his introductory note to *Wild Animals of Britain.* That there is still an abundance of England's native creatures, as shown by the author of this book, is a remark-

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*Formerly with the American Museum of Natural History, contributor to this magazine for many years.

able example of the tenacity of wildlife under adverse conditions. From the pages of this book the reader readily perceives that Mr. Pike has lived with the wild creatures of Britain since his childhood days and loved his friends in the woods, fields, and streams. He tells about these animals and his experiences in a manner that takes me back to my boyhood days in England when I captured alive a large venomous adder and kept it in the house a month before my parents learned the awful truth.

Mr. Pike does not limit himself to descriptions of the mammals, reptiles, and amphibians. Wherever possible he adds his own personal experiences with them.

There is a short chapter on the study of animals in general, where the author tells how to make friends with the wild creatures that have been hunted and persecuted by man from time immemorial.

By far the greater part of this book is devoted to the study of mammals, but there is a chapter on reptiles, introducing the snakes and lizards, and one on the amphibians—frogs, toads, and newts.

Wild Animals of Britain is illustrated with seven attractive color plates. The frontispiece is a red fox in full color with the appropriate caption "Dawn Patrol." Numerous interesting photographs of animals in action, taken by the author, add greatly to the instructive value of the book. While the title does class this book as somewhat regional, any nature lover will unquestionably find it well worth reading.

Mr. Oliver Pike is a well-known animal photographer and student of animal life. He is a Fellow of the Zoological Society of London, Hon. Fellow of the Royal Photographic Society and of the Institute of British Photographers, and a member of the British Ornithologist Union.

George G. Goodwin

Botany

- - - - - - - by R. Darnley Gibbs

The Blakiston Co., $6.00
554 pp., 261 figs., 118 plates

THIS is a textbook of botany designed for the introductory course at the college level. It is an all-inclusive type of text, fully ample for a year's work in this science. Unfortunately, most educational institutions can spare no more than a half year to introductory botany.

Unlike most currently used college textbooks in elementary botany, which introduce the student first to the morphology and physiology of a familiar higher plant, Professor Gibbs (of McGill University) has gone back to what he feels is a more logical "evolutionary approach." Thus he starts with the lowly algae, follows with the fungi, passes through the intermediate groups, and finishes up with a standard presentation of the vascular plants with emphasis on the anatomy and physiology of the angiosperms. Special chapters have also been included introducing the student to taxonomy, economic botany, "dependent and carnivorous plants," soil, phytogeography, and evolution and genetics. A brief bibliography is appended as well as "suggestions for further study," the latter to be found as a good concluding feature to each chapter. This text is well illustrated by both photographs and drawings. Many of these offer new subject material. In general, the drawings appear to be superior to the photographs, certain of which might have been better taken.

W. H. Hodge

Fish, fowl and foreign lands

- - - - - - - - by J. D. Greenway

Charles Scribner's Sons, $3.50
176 pp. 23 illusts.

THE jacket blurb says, "We must leave it to the reader to argue whether this is primarily: 1) An intensely amusing book about the oddities of diplomatic life . . . 2) An unusually delightful book about fishing in most corners of the globe by a fisherman with a very endearing personality." The author says the book is "the story of the belated conversion and slow education of a passionate fisherman."

Mr. Greenway's diplomatic career has led him to Rome, Prague, London, Moscow, Bucharest, Sweden, China, Persia, and Panama, with side trips to almost everywhere. In Prague he learned to fly cast, the result a "small and solitary trout weighing about a quarter of a pound . . . foulhooked and dragged ashore by brute force." This episode, by a Wodehousian logic, seems to have landed him in Woolwich to encounter life under a regimental sergeant. Big game anglers first met him as British Minister to Panama, and at the moment he is en route to a new post in Iceland.

The book is a choice combination of sense and nonsense, emanating from a quick, flexible, and extremely fine mind, which, just in passing, acquired the following languages: Rumanian, Greek, Persian, Portuguese, Chinese, and Russian. Added to this is an obviously classical education, omnivorous reading, and a spirit of adventure. There are vivid and delightful descriptions of the sights and smells of Chungking, the beauty of the descent from the Mazanderan Mountains to the Caspian Sea, fishing in the Em, the Laerdal, the Esk, and the Tweed; learning the Spey cast; five days on the Grimersta in the Outer Hebrides; big game fishing in the Galápagos, for Sailfish in Panama and for Bonefish and Tuna in the Bahamas, as well as superb wildfowl shooting near Bucharest and in the marshes outside Cairo.

As a woman, I would add that women, and also men who insist on taking them along, would do well to read the author's pungent remarks on the joy of being free to fish "untrammeled and unharassed by the female sex." I wonder who took the photograph entitled "Woman Fishing"!

Francesca LaMonte

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900 Lay Road, St. Louis 24, Missouri

The strange world of nature

- - - - - - - - by Bernard Gooch

Lutterworth Press, London, 10/6
160 pp., 29 wood engravings

THE wide scope spanned by this slender book may be seen from its contents: The first part deals with the animals themselves, the second with their approach to life, discussing eating and being eaten, protection from moisture, rearing the young, and the use of tools. The third part is devoted to problems of interpretation. This book is filled with a learned British naturalist's keen and affectionate observations on animals, ranging from sea anemones to rodents, and enhanced by Joan Hassall's wood engravings which live up to the author's level.

Although Mr. Gooch cannot conceal his deep love for all living creatures, he never permits it to degenerate into false sentimentality. He keeps equally aloof from any unwarranted anthropomorphism and emphatically cautions the reader against such interpretations of animal behavior, as long as better ones can be thought of. He propounds rational interpretation or else admits that we do not know the answer.

Combined with painstaking observation and recording, there is heart-warming humor throughout the book. Of the many anecdotes, this reviewer liked best the description of the crowded life of the guillemots on their narrow cliff ledges, resulting in the loss of many eggs every year and, eventually, in the feeding of a stolen fish to a stolen chick by adoptive parents.

Most of the author's examples, it is true, are taken from England's seashore and countryside, but this does not in any way reduce the value of the book to naturalists in other parts of the world. This book can be recommended most warmly to every nature lover. I, for one, enjoyed every page of it.

OTTO HAAS

INDIANS OF PERU

- - - - - Photos by Pierre Verger;
Text by Luis E. Valcarcel

Pantheon Books, $7.50
5 pp. of text; 87 pp. of photos

THIS attractive book is an album of photographs by an internationally-known French photographer and is prefaced by a pleasant, but exceeding brief, introductory text in English and Spanish by the Director of the National Museum of History in Lima. The title is somewhat misleading since the photographs actually cover a wide variety of subjects, including Inca fortresses, Spanish Colonial architecture, fiestas, and landscapes, in addition to Peruvian Indians. Each picture is excellent, and several are of exceptional quality.

The plates are organized into five groups illustrating all major geographical regions of Peru: the desert coast, the northern, central, and southern highlands, and the jungles of the east Andean slopes. Except for this general geographical grouping, the photographs have no larger unity and tell no consecutive, coherent story. Rather they are, as Dr. Valcarcel writes, "windows giving on Peru." While the book will be appreciated by anyone who enjoys outstanding photography, it will unquestionably mean more to the reader who has some firsthand knowledge of Latin America.

HARRY TSCHOPIK, JR.

RUXTON OF THE ROCKIES

- by Clyde and Mae Reed Porter
Edited by LeRoy R. Hafen

University of Oklahoma Press, $5.00
325 pp., 16 illusts.

THIS is largely autobiographical, but there are gaps in Ruxton's diaries and these are bridged over by data derived from several sources.

George Frederick Ruxton, an adventurous Englishman, lived from 1821 to 1848, and in that brief span of time tried his hand at soldiering, exploring, and hunting. His travels took him to Spain, to Africa, and to North America. He had a flair for adventure which is apparent from his choice of activities and also from the tenor of his writings. His military career was short, and most of the book is devoted to his activity as an explorer. As a traveler he was most interested in the hunting he could do, although he also made observations on the native peoples he encountered. He wrote two books, *Adventures in Mexico and the Rocky Mountains* and *Life in the Far West.* These are valuable as firsthand impressions of an environment and culture now vanished. His writings and his enthusiasm created a favorable impression in England, and he would doubtless have received support for further exploration had his career not come to such an untimely end.

Ruxton was self-reliant and did not lack for courage. On numerous occasions he took risks which might well have proved fatal if chance had turned against him. A cynic might conclude that these early drafts against the credit side of chance found him overdrawn when illness struck him. It is sufficient to note that the adventures he crowded into his few years would have been more than ample for the normal lifetime of the average individual.

This book will serve to direct attention to travels in North America that have probably not come within the knowledge of the average reader. It is in this field that Ruxton has made his greatest contribution. The incidents of his earlier life lack this unique character.

HAROLD E. ANTHONY

THE INCOMPARABLE VALLEY

A Geological Interpretation of the Yosemite

- - - - - - by François E. Matthes

University of California Press, $3.75
160 pp., 63 illusts.

"THE fullest appreciation of any landscape comes only when one is alive to its meaning also. Surely in the sublime Yosemite region this truth should provide an absorbing, even exciting intellectual adventure. We seek an answer to the question: By what circumstances did the Yosemite become endowed with scenic grandeur so exceptional that men have termed it 'the Incomparable Valley'?

"To answer this question has been the author's pursuit through years that have lengthened into decades; and to share with others the answers he has found has been his greatest happiness."

So wrote Dr. François E. Matthes, world authority on the geology of the area he writes about, a man whose technical reports on the region are classics in their field. Possessed, however, of a feeling of obligation to present his knowledge in terms that all who wished might appreciate the wonders of the area, Matthes, following his retirement from service as a government geologist in 1947, set as his goal the preparation of the present nontechnical account of the history of the Yosemite. This goal was not achieved; Matthes died in June, 1948. The work was brought to completion by Dr. Fritiof Fryxell, who had spent much of ten years with Matthes in the Yosemite and in the Washington offices of the Geological Survey.

"As fascinating as a who-dun-it is
DRAGONS
IN AMBER
by Willy Ley"
—*Book-of-the-Month Club News*

He brings us face to face with the survivors of antiquity, the animals and plants that roam the earth, the flora and fauna recorded in stone. This is his own special domain, this fabulous zoo of rare and elusive creatures and readers will discover it with delight.
Illustrated $3.75

By the Author of
The Lungfish, the Dodo, and the Unicorn

THE VIKING PRESS
18 East 48th St., New York 17, N. Y.

We have, then, in this book, an authoritative account of the Yosemite Valley, as its story has been read by the geologist. Its development is traced from the time that it was the valley of a small mountain stream in the young Sierras down to the present day, with special emphasis on the three successive periods of glaciation, when advancing ice sheets carved the features that make the distinctive scenery of today. The importance of the geology of the region as the determining factor in the effect of the glacial erosion is given major emphasis throughout.

The beautiful photographs by Ansel Adams are supplemented by others of equal charm, many by Dr. Matthes himself. The one illustration that is lacking is an adequate map of the valley, upon which the reader might be permitted to orient himself as he reads the descriptions of the many parts of the area. Dr. Matthes' detailed map published in his monumental report on the valley will not be readily accessible to most; it or one like it included here would add much to an already valuable work.

H. E. VOKES

IN SEARCH OF TH

OUR Chinese junk, the "Cheng-Ho," must have presented an odd sight to the Fijian natives on shore as the morning sun glanced off the gold, blue, and red-lacquered paintings on the ship's sides. For two hours we had paralleled the eastern shore of Vanua Levu Island, and at last our junk had turned out of the wind to enter the narrow channel in front of Tunoloa village. As the junk wallowed on the heavy swells of the dark blue cut in the reef, the great bamboo sails lowered slowly like folding fans. Abreast of us the large waves were swelling in from the open ocean and breaking in confusion over the long, offshore reefs. Ahead of us, in front of the Fijian village, a green-watered lagoon, placid and hot, offered a peaceful anchorage. And beyond the white, sandy beach, dotted with outrigger canoes, the village peeked out from a heavy growth of breadfruit trees.

By the time the anchor had let slip and its chain had snaked noisily overboard in a puff of rust dust, a large group of excited natives had gathered on the beach. This was the sixth landfall for the Harvard-Archbold Expedition to Melanesia in 1941, and in the past six weeks we had accustomed ourselves to the intricacies of landing among peoples whose inquisitiveness was exceeded only by our own scientific curiosity. Dr. Wesley Coulter, leader of the expedition, had learned to make his contacts early with the native chiefs or local British officials, so that his investigations on the agricultural conditions and geography of the area could proceed as quickly as possible. Mrs. Anne Archbold, owner of the modern junk-yacht, "Cheng-Ho," and our photographer, John Swingle, would generally land first and would Pied-Piper through the settlement and out into the country. This permitted a leisurely landing later for Dr. Otto Degener, our plant-collecting botanist, and for myself.

My main task was to amass a study collection of the land and marine mollusks of Fiji for Harvard University. Despite the many biological investigations awaiting the seashell fauna of this area, I could not help but turn much of my searches toward the rare and beautiful golden cowrie (*Cypraea aurantium*). At first, I had held a secret and greedy desire to return home with several dozen specimens, but as weeks slipped into months, I realized that its reported rarity was no myth. By now, I would have been satisfied with even a single example.

I went below to my cabin to finish work on rebottling and relabeling, an arduous and ever-present task which had been neglected while we were pitching and rolling on the high seas. The first launch went ashore immediately with Mrs. Archbold and company, and it was nearly an hour before I took my turn to the beach. I found the small village deserted and pleasantly quiet. I was rather surprised to find Tunoloa so neat and clean. Its attractiveness was due in part to the quaint European church and the two coral-stone mission houses that dominated the grounds. Around the high-walled church were clustered a dozen squat, grass huts, whose tiny gardens were shaded by large, spreading breadfruit trees. The unusual absence of rotting fruit on the ground accounted for the equally unusual absence of droves of flies. The central village yard and nearby paths leading out of the village were packed with clean, white coral gravel.

I stood for awhile deciding which trail to follow, then turned and headed north toward the collecting reef I had seen from the junk. At the north end of Tunoloa beach, where the sand gives way to a rather rocky stretch, a large, flat coral shelf juts out into the sea. At low tide a half mile square of coral rock is exposed. At this moment, the tide was just reaching the low mark, and the reef populace was just beginning to shut down for the hot, sunny hour or two that was to come. From the entire reef shelf came the faint, comical clatter of a million closing oysters and mussels. The awkward-legged crabs were rustling about for safe wet nooks in which to dream of more pleasant high tides. The small tide pools of perfectly calm, crystal-clear water sparkled in the natural matrix of rugged coral stems and rocks. My heavy reef boots crunched loudly on the eggshell mat of dainty corals. It was impossible to take a step without ending a thousand coralline lives, cracking a hundred shells into molluscan smithereens, or caving in the inner family sanctum of some tiny demoiselle fish.

The most pleasant and soul-satisfying collecting I have done has been in the tide pools of the seashore. On each occasion, when I have been in search of some particular tide-pool shell for study or drawing purposes, the hunt has turned into a combination survey of the marine animal kingdom and a tourist's excursion to a natural aquarium.

In addition to the numerous kinds of tide-pool gobies, blennies, and demoiselle fish, there are often young snappers, grunts, and squirrelfish trapped by the receding tide. The tiny inch-long demoiselle, with its bronze blues and gilded yellows, is the most beautiful of the shallow-water fishes, and yet the most ferocious in temperament. Take a step near the lair of a mated pair, and at once the tiny fish will dart out to attack the intruder. Although they are sometimes bold enough to attempt to bite, their small mouths, backed by a few ounces of body, can barely be felt.

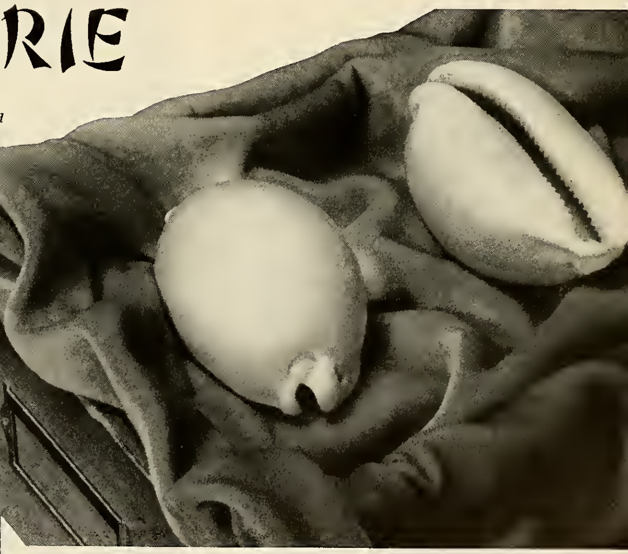
One of the rare
treasures of the sea
was the scientific
beachcomber's objective,
but he did not
count on the surprises
that nightfall
in Fiji could bring

By R. Tucker Abbott
Associate Curator, Division of Mollusks, U. S. National Museum

Courtesy of Mrs. Anne Archbold

▲ The expedition yacht, "Cheng-Ho"

GOLDEN COWRIE

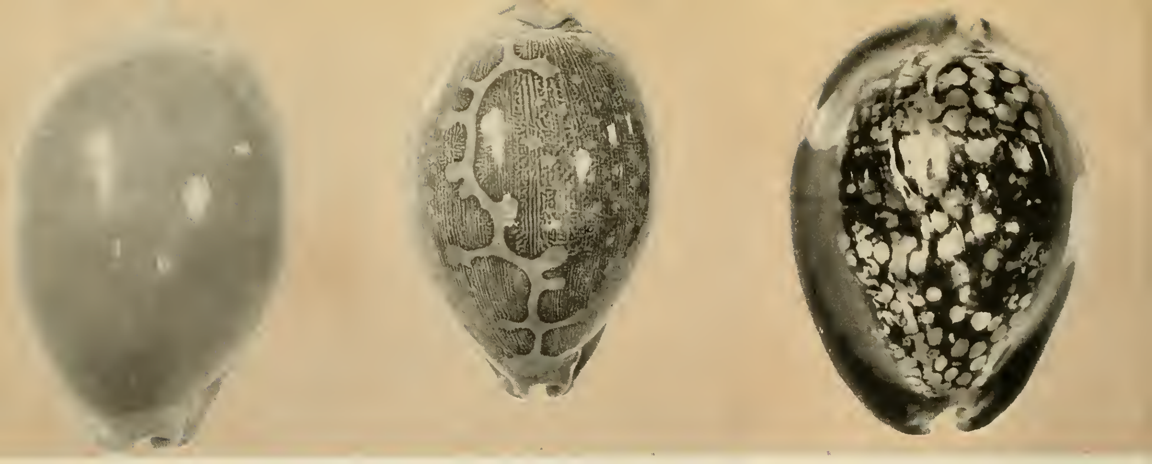


AMNH photo

▲ Our leading museums can boast of no more than 60 specimens of this much sought-after shell: the Golden Cowrie

Courtesy of Harry S. Ladd

◄ Somewhere among the coral-studded reefs of Fiji, the rare and elusive Golden Cowrie hides in undiscovered submarine lairs



▲ Six collector's items among the 160-odd known species of living cowries. All live in Fiji and other Pacific areas. *Left to right:* the Golden or Orange Cowrie, *Cypraea aurantium* Gmelin; the Map Cowrie, *C. mappa*

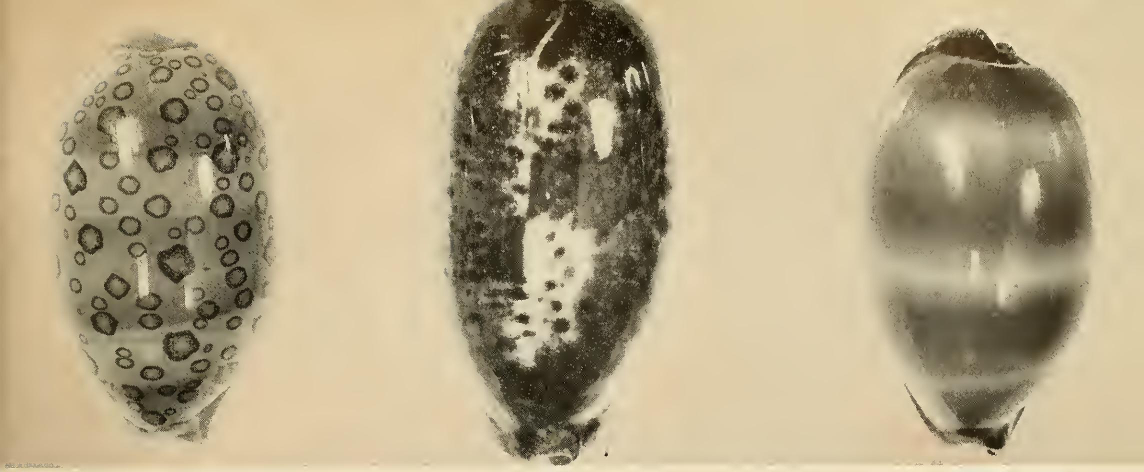
Courtesy of Mrs. Anne Archbold

▲ Friendly Fijians like this old fisherman are the only people who have ever seen a live Golden Cowrie

Other species of fish react quite differently to the presence of the splashing collector. The gray-speckled blennies sit motionless on the bottom, with bulbous eyes staring upward. The camouflage is perfect on gray sand or rock. Not until almost touched will the squatter budge—but when the spirit moves, he zips off with the speed of greased lightning, leaving a little whirl of sand behind. The rainbow-colored wrasse fish are entirely the reverse in temperament. Their inquisitiveness and insatiable appetite bring them swarming to each overturned rock in search of food. They will often mill around the collector with the boldness of a mosquito.

I worked slowly toward the outer fringes of the reef, turning over rocks and gathering specimens as I went. Each section of the reef has its peculiar habitat associations where certain species of shells are most likely to be found. Although the reef edge facing the open ocean is comparatively barren and most difficult to explore, it sometimes offers some surprising rarities that have ventured up from deeper waters. There are many natural haunts whose secrets are yet undiscovered by shell collectors, primarily because of their inaccessibility. For years, deep-water shells remained a great rarity. They are still highly treasured but are becoming more common in collections as modern dredging methods improve and as more amateurs take to this type of collecting. But it is not the inky depths alone that harbor undiscovered treasures. Coral reefs, such as these off Tunoloa, where, no doubt, the golden cowrie lives in some secluded chasm, are yet to be completely combed.

The cowrie shells have long been considered a family of aristocrats among the seashells. Novice collectors always marvel at the glossy, porcelaneous finish of these ocean gems and can scarcely believe that the colorful and lasting sheen of the shell is the work of the cowrie animal and not that of the buffing wheel and jeweler's rouge. Although many of the 160-odd living species of cowries are marked with extraordinarily bizarre patterns and characteristically display a wide range of hues, the golden or orange cowrie is outstanding for its simplicity in pattern and richness in color. The base or flattish bottom of the shell, where the slitlike aperture is lo-



Linné; the Humpback Cowrie, *C. mauritiana* Linné. *On this page:* the Eyed Cowrie, *C. argus* Linné; the Turtle Cowrie, *C. testudinaria* Linné; and the Mole Cowrie, *C. talpa* Linné. Slightly less than natural size

Smithsonian photo

cated, is a pure enamel-white. On either side of the aperture and a little within the opening, the sides are studded with orange teeth. On the sides of the shell and on the full, rounded top, the color is a solid cream-orange. In fresh specimens, the orange color is deeper and is highlighted by an almost golden glow. A four-inch golden cowrie without cracks or tarnish and resting safely in a drawer on black velvet cloth is a treasure sought after by many thousands of collectors.

In addition to its relatively large size and attractive appearance, the golden cowrie possesses four other qualities that place it among the high-priced seashells. It is rare in nature and uncommon in shell collections; its animals, eggs, and habits await scientific description; and it is connected with an interesting history. This is the same combination of factors that raises the sales value to several hundred dollars for such species as the Glory-of-the-Seas cone shell (*Conus gloriamaris* Chemnitz) and the white-toothed cowrie (*Cypraea leucodon* Broderip).

Since, as we are led to believe, the golden cowrie lives in fairly deep waters on the seaward slopes of fringing coral reefs, it is rarely captured except after violent storms. Although its geographical range extends from the Philippines to Melanesia, this species occurs in very localized regions. One such "pocket" exists among the small islands off the Surigao Peninsular of Mindanao Island in the Philippines, another along the southwestern coast of Viti Levu Island in Fiji; and there are still others of lesser importance throughout the other Fiji, Palau, and Solomon Islands. Undoubtedly, many other "nests" await discovery.

There are probably no more than 500 specimens in private hands in the United States and Canada. Our leading museums, all told, can boast of no more than 60. The aggregate of European and American collections probably outnumbers those in native Fijian hands by ten to one. A hundred years ago, the golden cowrie sold in Europe for over $100, but as the demand gradually declined they dropped to one fourth this value. The present-day American market is slightly on the increase with

Courtesy of Mrs. Anne Archbold

◂ THE EXPEDITION enjoys the simple hospitality of a Fijian village. *Left to right:* the author; Dr. Wesley Coulter, leader; Mrs. Anne Archbold, owner of the junk "Cheng-Ho"; Miss Mary Keegan, nurse; and the Reverend J. Ferris of Taviuni, Fiji

Courtesy of Mrs. Anne Archbold

◄ Two **Fijian** maids sporting ceremonial skirts of tapa cloth

sales ranging from $20 to $60, depending upon condition of the specimen. Throughout the ups and downs of the American market, the value of the orange cowrie has remained fairly constant in Fiji itself. As early as 1860, the Fijians had largely abandoned the custom of punching a hole through the shell and hanging it around their necks. In the early days, it was akin to a royal crown and was worn only by high-ranking chiefs. Today, it readily brings $2.00 or $3.00 when taxes are due or clothing and medicine are needed. An Indian shopkeeper becomes exceedingly patronizing when a troubled native rolls a golden cowrie on the counter.

Most cowries are nocturnal in habit, and long before the morning sunlight has reached the reef, they have crawled to safety under rocks and protective ledges. On the first occasion of tropical reef collecting, I turned over a slab of coral to find a large colony of what I at first thought to be some strange and beautiful nudibranchs or soft, fleshy sea slugs. I gave one a poke, and to my amazement it seemed to split down the middle by peeling back its colorful, fleshy cloak to reveal a glistening, gemlike cowrie shell! The fleshy mantle of the animal extends over the entire shell and is continually secreting thin layers of new and colorful enamel. In many species the mantle is much more attractive than the shell. Not only does it often display a wider range in colors, but in many species it is studded with numerous, frondlike fingers and bizarrely designed warts.

The eggs are laid by the females under protective rocks. The finger-shaped, horny, but soft capsules are deposited in small, round clumps. Each of these capsules contains several hundred microscopic eggs, which later grow in size, develop a tiny snail shell, and finally emerge as free-swimming veligers. The swimming period lasts for a few days, and then the young shed their tiny "hairy oars" and settle to the bottom to start their life at a normal snail's pace. Growth takes place in the normal spiral manner of a snail, with additional whorls or turns being added to the lip by the shell-depositing mantle. Just before sexual maturity is reached, the thin lip grows inward, thickens, and finally adds teeth. There are reports that the females sit over the eggs to protect them while they are developing. This is probably true, as I have rarely found egg clumps without an adult on top.

By some good fortune, when Nature was devising the exquisite patterns of rich chestnut dots and gray flecks for the tiger cowrie (*Cypraea tigris* Linné), she allotted to that large, handsome species the qualities of abundance and far-flung distribution. Whether collecting in Polynesia, Australia, the East Indies, or the distant shores of East Africa, I always look forward to meeting this old friend. The size, color pattern, and habitat preference differs in various localities. Here at Tunoloa, the tiger cowrie is uncommon, although only a few miles to the south in more protected waters it is rather plentiful. There the shells are larger in size, attaining a length of four inches, and at least half the population has shells with heavy blotches of cream-white. Recently, during a collecting foray in Tanganyika, East Africa, I stumbled across a colony of some 100 specimens nestled among the eelgrass leaves of a shallow flat. Few were over 2½ inches in size, and most were characterized by extremely dark coloration. Colonies of these dwarfs exist in widely scattered localities —Okinawa, Queensland, Halmahera in the Dutch East Indies, and Tanganyika. A giant race lives in moderately deep water in Hawaii.

It was now full low tide, and from a distance across a half-mile stretch of water I could hear the boom of the ocean surf on the outer reefs. The clear, sparkling breakers, the vast areas of freshly exposed corals, and the quiet, shallow waters ahead of me were all an incentive to desert this inner shore reef and head for the outer barrier. I set out hurriedly on a long, coral-crunching walk, for I knew that the tide was due to turn soon. At first, I passed patches of bushlike corals where the quiet waters had allowed them to develop to the extremes of daintiness and form. Nearer the outer reef, the corals were stunted in growth

Courtesy of Mrs. Anne Archbold

◂ **Fijian women beating** strips of the bark of the paper mulberry tree to make *masi,* or tapa cloth

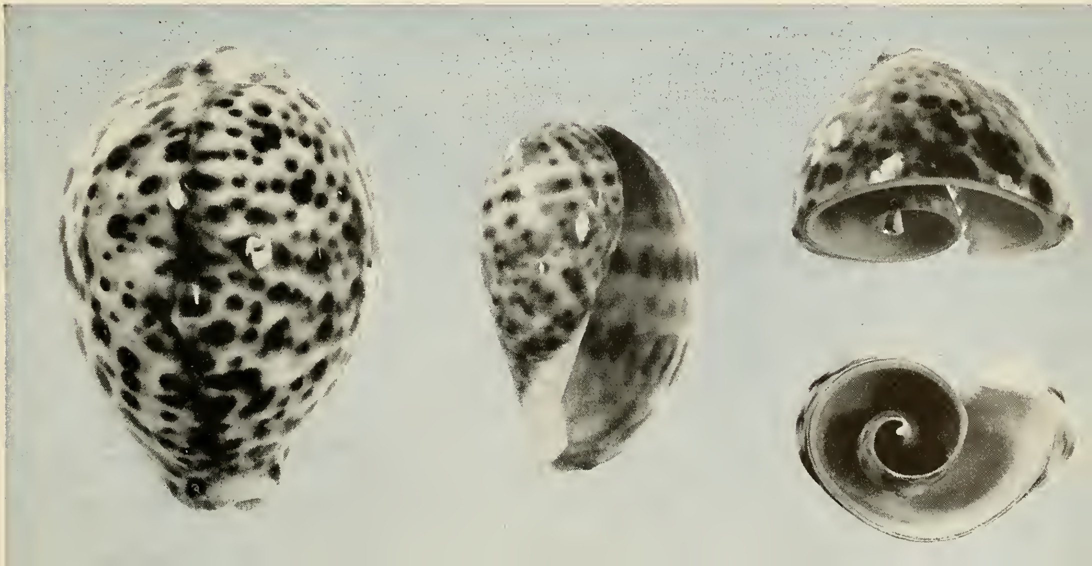
and much less imaginative in form. On the outer, wide rim of the reef, where at high tide the gigantic waves sweep over in great strength, the corals were worn and beaten down to almost smoothness. It was no effort to walk along this natural highway at low tide. The ocean edge of the reef was another story.

Here the ocean and reef are at their wildest. The great coral-lined fissures and bottomless holes are continually awash even at low tide. Occasionally I could glimpse a sudden flash of some colorful reef fish deep down in the blue water. The wildness of the outer reef is in direct contrast with the sleepiness of the lagoon-bordering reef. At low tide, as each wave smacks the coral wall, the reef trembles, and great geysers of spray leap up in the air, drift slowly in the wind for a few seconds, and then splatter noisily down on the reef. At half tide, the breakers are smashing over the top in swirling confusion, scouring each channel and pothole with ruthless efficiency. At high tide, the reef is completely covered by ten or more feet of sea, but the powerful, restless breathing of the sea swell continues to exert its frightful force.

Despite the great quantity of living coral and coralline algae, the unusually beautiful water holes, and the abundance of fish, sea fans, and other forms of marine life, I could find very few shells on this section of the reef. The tide was coming in at a smart clip, and all at once the little coral plateau on which I was collecting was awash. It always seems that the most interesting rocks are yet to be investigated when the tide is ready to turn. Each successive wave that rises from the ocean smacks the side of the reef a little harder, and each new gush of spraying water splatters nearer shore. From a cut in the reef a huge wave bulges up and spills out in every direction,

▾ **The enamel-coated Tiger Cowrie** grows in spirals like most snail shells. But upon reaching maturity, it curls in the fragile lip and develops thickened teeth. *Left:* top view of adult; *center:* immature specimen showing the aperture and fragile outer lip; *right:* an adult cut in cross section to show the manner of growth (*Cypraea tigris* Linné)

Smithsonian photo



sending layers of water galloping along the reef plateau. There seems to be a sigh of relief from the reef as the cool, fresh sea water reaches the sun-baked corals and rocks. I always watch this process of marine rehabilitation with satisfaction, as if I were hosing a dry garden on a summer evening.

When collecting is over, weariness soon follows. Kicking through the water back to shore is like stomping through the autumn leaves on the weary way back to school. The joys of the holiday reef are memories, and the arduous task of cleaning and packing the catch lies ahead as a form of distasteful homework.

Beyond the grove of palms that rimmed the beach, the billowings of a distant storm pulled at their chains of lightning in the southern sky. The afternoon sun had long since lost its white hotness of noon. The storm was coming up from the south, and the stiff breeze that sent the waves crisscrossing sloppily up the beach slope was rushing with a clatter through the palm fronds. By the time I reached the mission house, the sun had dimmed behind the wisps of high cirrus that fanned out from the tops of the thunderclouds in the distance.

I walked to the other end of the village where a *masi* or tapa-making exhibition had been arranged for the benefit of our party by Father John Clerkin. Four or five native girls were squatted around a large grass mat on which were spread great sheets of white tapa cloth. From time immemorial the South Sea Islanders have developed and carried on the art of making this crude cloth from the paper mulberry tree. The newly made cloth is as soft as cotton. Today it is made for decorations, ceremonial dress, and tourists, but before the white man's introduction of the Mother Hubbard and cloth skirt, it was used more frequently as a wearing apparel. Tapa is used as bandages, swaddling, and bed cushionings and, in a thin form, smoked to a delicate tan, as a head wrapping for chiefs.

The bark of the mulberry tree is stripped from the stems in small sheets. A great number of these strips are pounded together with a little arrowroot paste as adhesive. Thickness and size may be varied by the number of smaller strips employed. The finished cloth, when dry, is decorated in complicated designs. Fireplace soot, a dye from the *lauthi* or candlewood tree, and the red juice of *tongotongo* berries are most commonly used in Fiji. Each island group in the South Seas has its characteristic design, and an expert can identify the origin of any piece.

Although the storm had partially dissolved to the south, a few scuttling gray clouds threatened directly overhead, and the girls picked up their tapa and scurried home. Father John and I sauntered back to the mission house. The air had turned cool, and the light breeze carried a smell of fish and fog that made me homesick for Cape Cod. Father John was silent, too, and no doubt he thought of the quays near Baile Atha Cliath (Belfast, Ireland) when the fog is drifting in from the sea. The urge to see home never lingered with me, for I knew that I would have to start back in not too many months; but for those who were ordained to stay and educate the natives, the transplanting was not without its moments of drought.

A goodly part of the next morning was spent aboard the "Cheng-Ho" in cleaning and preserving the previous day's catch. By the time I was ready to go ashore, the tide was already coming in, so I decided to make a short excursion into the hills for land shells. When headed for the reefs, my hopes had been highest for a golden cowrie, and when headed inland through the jungle growth, such thoughts were furthest from my mind. Yet, by odd chance, it was on this land trip that I obtained my first specimen.

I had been back in the hills working slowly up a fresh-water stream for three hours. Just as the Fijian dusk was beginning to ooze up from the glens and ravines, I called a halt to my collecting and started back for the junk. The narrow, soft-earthed path that wound in careless turns down the hill, the dark green forest that towered high and silently on every side, and the occasional faint whiff from some sweet-scented flower were all an inducer of slow walk and daydreaming. I thought of sailing-ship days when whalers first came to the Cannibal Isles. A sudden flutter of black wings and a series of eerie squeaks down the path a short distance ahead made me freeze in my tracks. A prickling sensation flashed up my back to the nape of the neck. Then I saw three giant fruit bats crisscross up into the air from a lone papaya tree and dodge away in the growing darkness.

It is uncomfortable to be frightened over nothing, and I quickened my steps in anger. A dozen times, it seems, I had started up a ravine or alongside a small stream that ran back into the jungle hills. The golden-yellow patches of noonday sunlight flickering through bright green foliage, the merry gurgle of water on the moss-bordered rocks, the tree ferns standing gracefully on the steep banks, the colorful flash of passing butterflies, the cheerful watery warble from a hidden bird—all these cast a fairyland spell that kept me climbing farther and farther. Collecting was often forgotten in my excitement to see what was around the next bend. I always knew when I ought to turn back, but often I was hypnotized by the strange beauty of the forest.

But eventually comes the moment when the soul that responds to beauty reaches a saturation point. Loneliness does not creep up slowly; it flashes on the scene. The back must be turned on the next bend. The inquisitiveness that is part of the road ahead becomes a memory of the long road back. The tough vines along the bank will not give way, the rocks in the stream are slippery and dangerous. A dozen turns are strangely new and seem recently placed there by some malicious fairy to lengthen the way home. Dusk is

Continued on page 144

"Poor-me-One"

The mystery of the jungle's most haunting sound—a call so human and so suggestive of hopeless sorrow that it baffled and distressed man for centuries

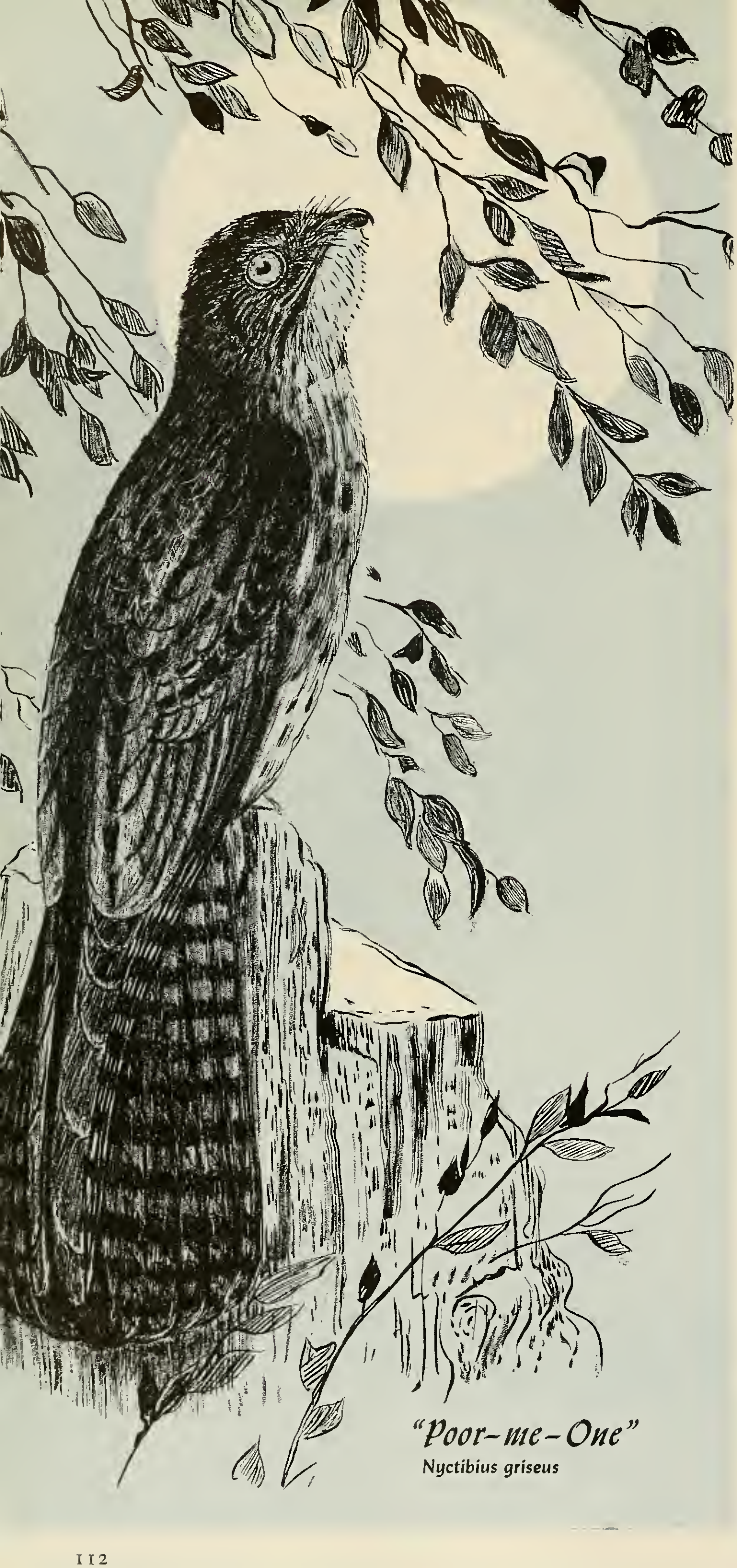
By William E. Lundy

MOST persons who love the jungle and turn to it for pleasure and relaxation find an absorbing pastime in listening to the myriad voices that come from its depths. So great is their number and variety that no single person could name all the creatures heard during a 24-hour period. It may take months or even years to discover the maker of a certain sound, but the thrill of solving such a mystery is ample compensation to the lover of nature.

Should a stranger find himself in our jungles in the Panama Canal Zone, and were he so fortunate as to be able to link all of the calls to their sources, he would find many strange and interesting "ventriloquists." He would hear the roar of lions and the barking of dogs coming from howler monkeys, the laugh of a fat man from a baby alligator, and the whistle of a boy from the snout of a young tapir. He would hear Swainson's Toucan calling with the voice of a frog; and the "dong" of a small silver bell would come from the throat of a tiny tree frog. One of the most deceptive sounds would be the soft birdlike call made by the kitten of the yaguarundi, or "Whistling Cat." No one would imagine that such a sound could come from a feline.

But one voice has fascinated me more than any other, and I guess that in all tropical America you could not find an animal that has perplexed and disturbed naturalists the way this one has. It is so utterly unique and weird that it has brought forth comments by many writers over a period of four centuries. It is heard only between dusk and daybreak, and few people can boast of having spied the creature in the act of making this uncanny call. When the ornithologist Dr. John T. Zimmer heard it in Peru, the natives told him that it was a lost soul—an *alma perdida*—and that he would naturally never be able to shoot it.

Dr. Frank M. Chapman sat spellbound as he listened to this call from the jungle just beyond the clearing of his "Tropical Air Castle" on Barro Colorado Island in the Canal Zone. It had been 37 years since he had heard it before in Trinidad, but he recognized it at once as the call of the "Poor-me-One," a name meaning in the Negro dialect of Trinidad "Poor me, all alone." When describing the experience in 1893, he said, "At first I thought it was a boy. It was a soft but loud, sad, flutelike note. I have never heard such a human sound from a brute before. It made the goose flesh rise all over me." Years later he said that the voice of this creature has such richness of tone



"Poor-me-One"

Nyctibius griseus

and is so suggestive of sorrow that ". . . in all the world of birds or man I have heard none sweeter nor sadder. So strongly does this song express human emotion that one thinks of it as a woman's voice—a deep, mellow contralto calling in hopeless grief."

Gonzalo F. de Oviedo y Valdés, first chronicler of the Indies, is believed to have had this call in mind when four centuries ago he described a sound differing from that of all other animals, beginning with a high note and descending for six points: "Ah, ah, ah, ah, ah, ah."

Doubtless it was the same call that Charles Waterton, an English naturalist and explorer, described in South America in 1816 as being so remarkable that having once heard it, you will never forget it: "When night reigns, . . . you will hear this lamenting like one in distress . . . A stranger . . . would say it was the departing voice of a midnight murder victim, or the wailing of Niobe for her poor children, before she was turned to stone. Suppose yourself in hopeless sorrow, begin with a high note, and pronounce, 'ha, ha, ha, ha, ha, ha, ha,' each note lower and lower, till the last is scarcely heard, pausing a moment or two between every note, and you will have some idea of the moaning."

A few years later an English clergyman, Charles Kingsley, told of an experience in British Guiana. "Then something . . . —and I do not deny that it set me more aghast than I had been for many a day—exploded I say . . . with a shriek . . . such as I hope never to hear again . . . after which, happily, the thing, I suppose, went its wicked way, for I heard it no more . . . for most ghostly and horrible is its cry."

A Balboa resident once told me that she had heard the cry for the first time when she was alone in her home on Morgan Avenue and that she thought it was the wife of a neighbor being beaten unmercifully. She, too, said she hoped never to hear it again.

All agree that the call of "Poor-me-One," once heard, is not likely to be forgotten. Residents of Quarry Heights and sections adjacent to Ancon Hill are fortunate—or unfortunate, according to the point of view—in that they may be awakened at daybreak by this voice of the jungle. Sometimes it is heard from nightfall till midnight. On a still night, the cry can be heard for half a mile; and on moonlight nights, it may come at intervals throughout the night. I first heard the call from Ancon Hill some fifteen years ago. It so closely fitted the description given by Dr. Chapman that I knew it must be the "Poor-me-One." I have heard it many times since.

Explanations

There has been considerable difference of opinion as to what creature makes this call. The historian Oviedo gave credit to the sloth. Probably he was passing along the belief of the Indians. In any case, this myth has been handed down for the past four centuries and is still believed by many today. On the night that Dr. Chapman first heard the call on Barro Colorado, he called to the keeper, "Donato, what is that calling." The reply was, "*Perico Lijero,*" a nickname given by the early Spanish visitors to the three-toed sloth. It was the first time that Dr. Chapman had known Donato to be wrong. A laborer from southwestern Colombia gave him the same reply, showing how widespread this myth has become.

In 1893, when Dr. Chapman first entered the forests of southern Trinidad, he had been told to listen for the song of the two-toed anteater. The notes of the song were described to him so well that when he heard it from the forest he did not doubt its author. After observing a living anteater for some weeks, however, he began to doubt the local belief that it was the "Poor-me-One." A year later he returned to Trinidad and, in company with Albert Carr, a local naturalist who had solved the mystery, actually saw a "Poor-me-One" calling.

What animal, then, had frightened, bewildered, and moved with deep emotion so many jungle travelers?

It was a bird—of the goatsucker group.

If I had had any lingering doubt as to the correctness of this, it would have been wiped out just after daybreak on June 10 of last year, when I was awakened by an unusually loud cry. From my bedroom window I could see a bird perched on the top of a pole some 40 feet away and silhouetted against the sky. It seemed incredible that this bird, with a length of hardly more than 12 inches, could be the author of a cry of such volume; yet as I watched it, it repeated its loud six-note call. Its body vibrated perceptibly with the force put into each note. Then it flew into the trees across the street, where it called again. The bird returned at dawn on June 12 and again flew away after calling twice. From then until 3:00 A.M. on July 4 it was seen eleven times perching on the pole, preening its feathers, and occasionally darting out a few yards after insects. On two occasions it remained on the pole until it had sung its pathetic song through seven times. After July 4 it was not seen again. Probably the fireworks on that evening had frightened it away to the jungle growth higher on the hill.

Heard from a distance of only 40 feet, the call of "Poor-me-One" has, in addition to the six notes already described by others, a sound like a gasp for breath following each note except the last. One person who had heard it from a short distance thought that the sound was made by flapping the wings against the perch between the notes of the call. I believe it to be made with the throat. In contrast to its famous—or notorious—cry, it gave another cry several times, low and very deep-throated yet very soft, sounding like "Oo-ah, oo-ah." I doubt that it would be audible at a distance of 100 feet.

Our Panamanian "Poor-me-One" is not consistent in the number of notes used in its song. While the call is usually composed of six notes, the bird has been known to utter eight notes, and several times only four were used. And though I do not yet have visual proof, I am convinced that on rare occasions its cry is reduced to one long heart-rending wail, quite as disturbing in its effects on the listener as is the six-note cry.

Unlike many of its relatives (the nighthawks, whippoorwills, etc.), which perch horizontally on limbs of trees or on the ground, "Poor-me-One" prefers an upright position almost parallel with the perch.

Almost as singular as its calls are the nesting habits of this strange bird. Having selected, through design or instinct, a broken tree stump whose coloring blends well with its own, "Poor-me-One" deposits a single egg in a cavity so placed that it can be incubated while the bird perches in an upright position. Sitting there with its tail pressed firmly against the trunk of the stump, its eyes closed to mere slits, its neck stretched to full length, and its head pointing upward, it becomes to the casual observer a part of the stump itself.

No feathers, twigs, or down line its crude nest, for so well is the cavity selected that little or no room remains for more than the egg. Speaking of a nest that he found in Trinidad, Mr. Alec Muir said, "How the bird managed to place the egg there I cannot imagine. The egg exactly fitted the cavity. There was no room to spare. It could not be moved from side to side, but I could revolve it gently with my fingers."

Within a day or two after hatching, the young bird has assumed the upright posture of its parents, its creamy-white down blending as a patch of fungus on the stump. So tenaciously does it cling to the nest that during its early life it may not be pulled loose without danger of damage to its soft body.

Yes, this is a most extraordinary bird. If you ever hear it call, you will never forget it. Many have fallen under the spell of the jungle—its sights and sounds and smells. But those who have heard it agree that the most haunting song to voice the jungle's timeless mystery and pathos is the call of the "Poor-me-One."

Harold McCracken photo

➤ SPLIT ROCK, OF Fortress Island, off Unalaska Island, on top of which four mummies were found by the Stoll-McCracken Expedition, mentioned in the accompanying article

MUMMIES FROM ALASKA

Adventure and misadventure were partners to those who searched for the strangest things to come out of the North

By ALAN G. MAY

Vice President, North Central Washington Museum Assn.

WHEN mummies are mentioned, most people's thoughts turn automatically to Egypt. Undoubtedly this is because the Egyptian mummies are by far the most spectacular and because they represent the highest known development in mummification. More literature can be found relating to Egyptian mummies than to all the rest of the mummies in the world added together.

Alaska is one of the many places in the world where mummies are to be found, though the mummies from Alaska have little in common with those of Egypt. In both cases an artificial process of preservation was used and the internal organs were removed; beyond this there is little similarity.

Early explorers of Alaska, as far back as 1790, reported that the Aleutian Islanders had a strange habit of mummifying their dead. Their information came from the Aleuts, not apparently from direct observation.

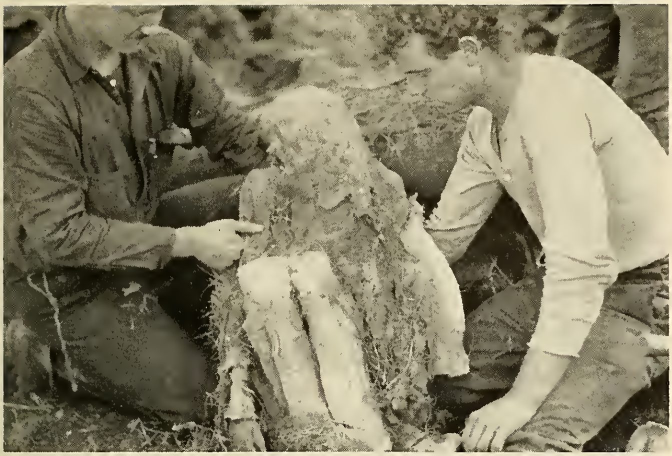
Father Veniaminof, a priest who was later made Bishop of Alaska by the Russians, lived for ten years among the Aleuts and became their friend and mentor. In his journal he recorded the process of mummification as told to him by the Aleuts, and this is the earliest account from Alaska that we have. It was 52 years after Veniaminof arrived in Russian America that the first mummies from his beloved islands reached the United States.

In 1875, twelve mummies from the Aleutian Islands arrived in San Francisco, through the courtesy of the Alaska Commercial Company. The company had instructed their men to procure, whenever possible, any material of scientific interest that they came across during their travels. The twelve mummies had been found by the captain of a small ship when it put in at Kagamil Island to pick up some hunters.

It was not until the American Museum's Stoll-McCracken Expedition of 1928 that the next mummies were brought out of Alaska. The expedition's archaeologist, Dr. Edward Weyer, Jr., now Editor of NATURAL HISTORY Magazine, and Junius Bird, who has for many years been on the staff of the Museum's Arthropology Department, reported the finding of four mummies on Split Rock, a small and precipitous island in the Aleutian chain. These mummies were found in a most unusual wooden sarcophagus on the summit of the island and had to be lowered by ropes.

No further mummies reached the United States from Alaska until 1936. At that time the late Dr. Aleš Hrdlička of the Smithsonian Institution commenced an archaeological survey of the Aleutian Islands which continued through the years 1937 and 1938. During this period a large number of mummies were found. The writer accompanied Dr. Hrdlička throughout the three years' exploration.

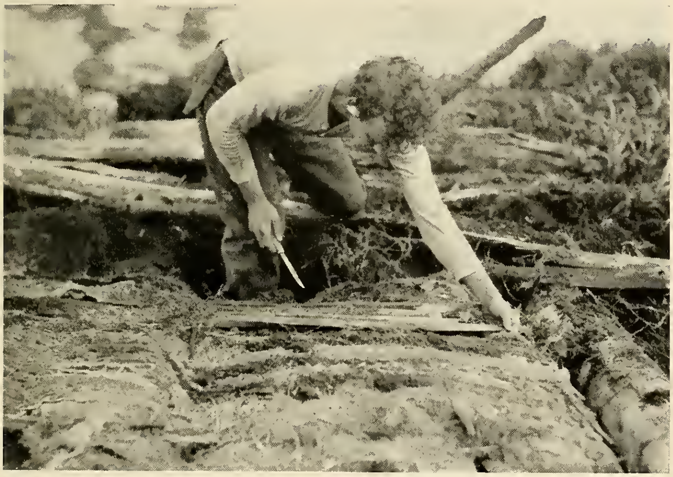
One of the several objectives of these expeditions was the search for mortuary caves containing mummies, and considerable preparation was made for this phase of the



◂ THE MUMMIES from Split Rock, like the other Aleutian mummies, were doubled up. They were clad in garments of grass matting

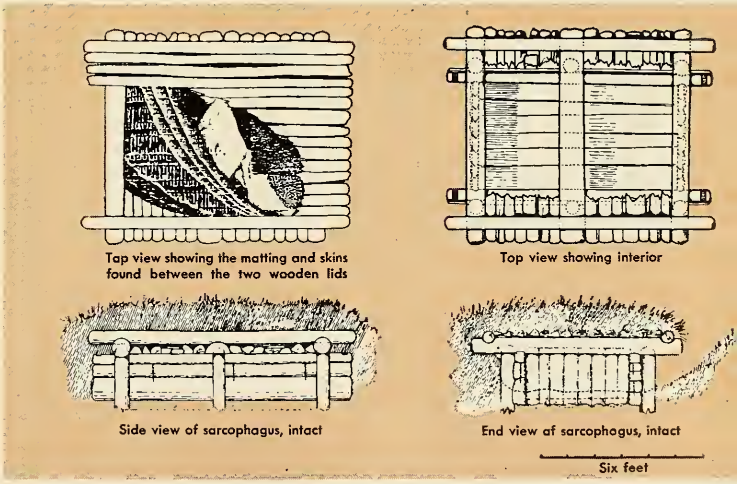
▾ CHARLES STOLL and Harold McCracken holding the flag of the Explorers Club over one of the mummies from Split Rock

Harold McCracken photos



◂ THE MUMMIES were found in this elaborate driftwood sarcophagus beneath the sod. Junius Bird is here seen removing the top layers

▾ A DRAWING showing details in the construction of the sarcophagus and the layers that formed the top



Top view showing the matting and skins found between the two wooden lids

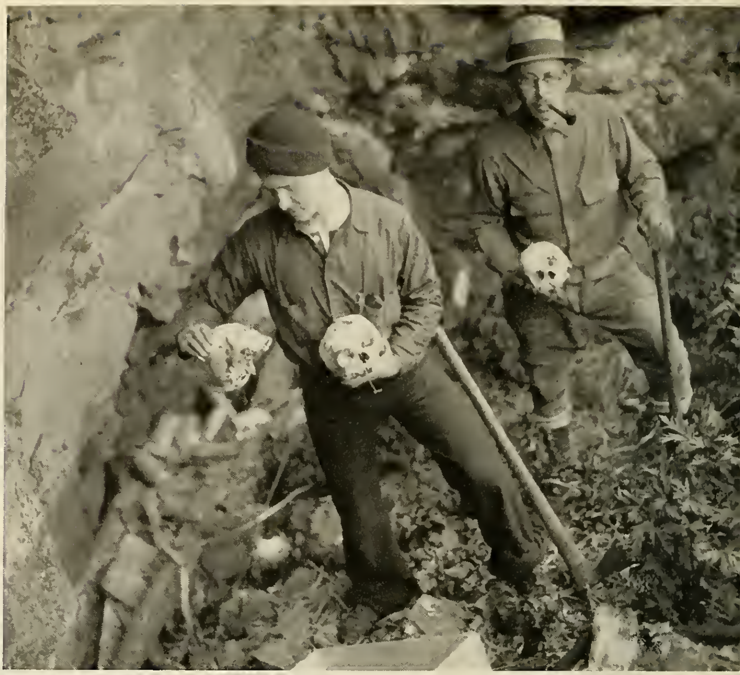
Top view showing interior

Side view of sarcophagus, intact

End view of sarcophagus, intact

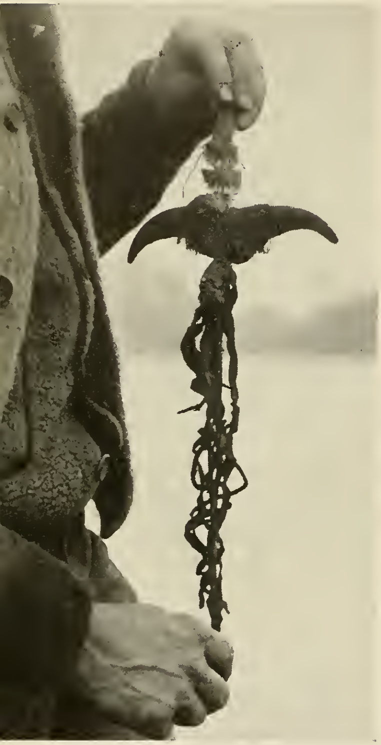
work. All available records were examined for possible clues to the locations of mummy caves. Whenever possible, information was obtained from the older Aleuts who claimed knowledge of the caves, as well as from Alaskan old-timers. The late Reverend A. P. Kashavarof of the Alaska Territorial Museum, Juneau, searched through a number of old Russian books and manuscripts, translating and typing parts that might be of use in the quest. Veniaminof's report concerning mummy caves on Kagamil and Tanginak Islands was, of course, well known. Tanginak, now known as Ship Rock, was a familiar sight to the thousands of serv-

➤ **Skulls** found in a rock shelter lower down on Split Rock Island



Harold McCracken photos

⮟ **Possibly** the emblem of a chief or a sorcerer: an ornament made of bear's teeth and human teeth, found with the mummies on Split Rock



icemen stationed at Fort Glenn on Umnak Island. Fort Glenn was renamed Cape Air Force Base in 1948.

Most of the leads and clues were followed up during the three seasons spent in the islands. Many proved fruitless. It was only at the two locations specified by Veniaminof that mummies were actually found in the caves.

Kagamil is one of a group of five islands known as the Islands of the Four Mountains, lying to the west of Umnak. The island is small, with a rugged rocky shore line, and it has no harbors. Smooth seas are essential for a landing, but it is a rare occasion when the waters are really calm. Adding to the difficulties of the Coast Guard in taking the party to Kagamil was the fact that the waters around the Four Mountain group were not accurately charted in 1936.

Further proof, if indeed such was needed, of the existence of mummies on the islands was forthcoming when the expedition was working on Kiska. Dr. O. J. Meury of the Biological Survey stopped at Kiska to present to Dr. Hrdlička two mummies which he had found on Kagamil a few days earlier. Fortunately, too, Dr. Meury was able to describe a definite landmark near the cave—one that could not be missed. About one quarter of a mile from the cave was a large *solfatara*, or vent in the cliff from which bellowed forth gases and steam. This was valuable information, for it saved much time and searching on arrival at the island some weeks later.

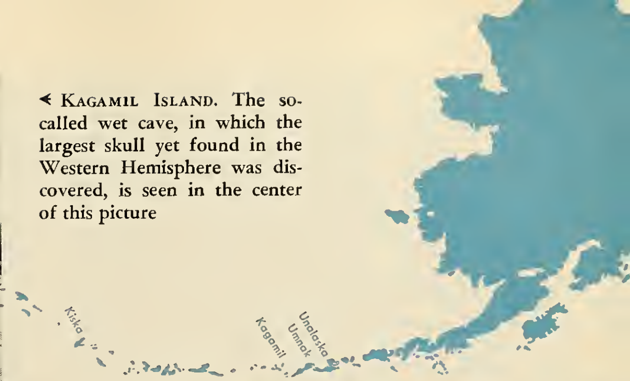
Because of high seas and an impenetrable fog, the first attempt to reach Kagamil ended in failure. However, although the weather conditions were far from favorable, a difficult landing was accomplished near the *solfatara* on the second attempt a few days later.

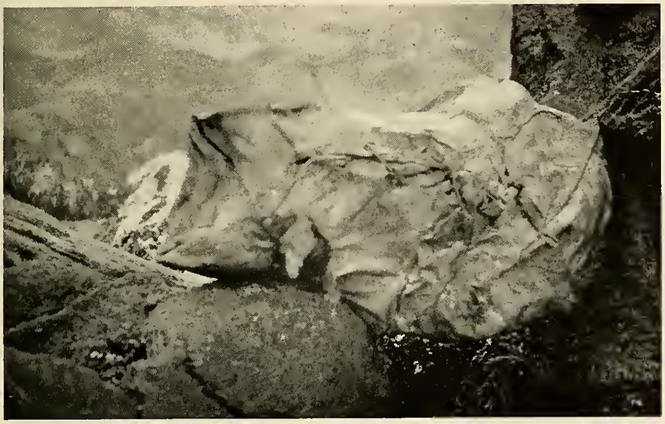
Many small jets of steam issued from the rocks just above the water line. Boiling water gurgled among the boulders and crevices, and in some places the ground was warm. Near the top of the cliff, where moss was the only vegetation, both the ground and the moss were warm to the touch. Each footprint in the soft moss left a small plume of steam.

Not far from the *solfatara,* the cave was found at the base of a vertical cleft in the rock cliff. The interior of the cave was of irregular shape, with a ceiling so low that it was only possible to stand upright at the entrance. Loose rocks, boulders, a few human bones, and bits of matting lay on the uneven floor, which was a few feet below a natural rock shelf. The poor light caused by this rock shelf and the low ceiling made flashlights most valuable. Throughout the cave—in the ground, on the boulders, and adhering to the walls—were quantities of a dirty white, near-crystalline material—perhaps a form of siliceous sinter. It is not impossible that at some

Alan G. May photo

◀ **KAGAMIL ISLAND.** The so-called wet cave, in which the largest skull yet found in the Western Hemisphere was discovered, is seen in the center of this picture





▲ **A MUMMY** in its wrappings. The grass rope that bound it was lost in transportation from the cave to the shore

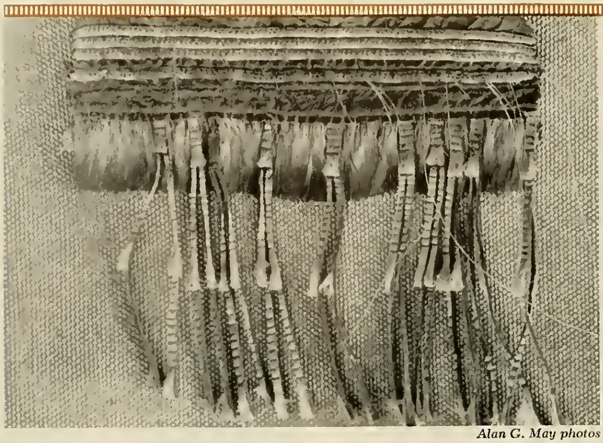
➤ **THE** *solfatara* or steam vent on Kagamil. Steam blew continuously from this opening in the earth, with a loud noise

time in the distant past this cave was another large *solfatara,* the whitish substance having been deposited by the gases.

We discovered our first mummies just below the floor level. They had apparently been covered by natural causes over a long period of time. Foxes had denned in the cave, adding to the debris; they had also chewed on some of the mummies. Aside from the fact that a large number of mummies were found together, one on top of another, there was no apparent system of placement. There were a few isolated mummies; sometimes two or three were found tucked away in some corner or niche. It would seem that after the main depository was full, mummies were placed wherever room could be found for them in the cave. Two kayak frames were uncovered in one recess. Rumors have been frequently heard of persons who claimed to have seen mummies holding paddles in their hands, sitting in kayaks or bidarkas in burial caves. However, there were no mummies in these kayaks.

Many mummies were discovered, mummies of men and women and many children. As the excavations went deeper, the ground became warmer, until near the bottom it was too hot for comfort. We frequently had to pause for a breath of fresh air at the entrance because of the dust stirred up by the work. Near the center of the cave on the rock bottom was a large slab of stone that took the efforts of three men to lift. Below this, in a hollow, were found the remains of a multiple cremation burial.

Buried with the mummies in the accumulated debris were many beautifully made wooden bowls (*kantags*). Other specimens uncovered were arrow or dart points of stone and bone, stone knives, mummified birds, and a large number



Alan G. May photos

▲ PART OF an elaborate fringe from an Aleutian mummy garment. It was made from fur, animal skins, breast skins of water birds, feather, and hair. Red, gray, black, and white hair was used in it

▲ A WOODEN BOWL from one of the mummy burials, left there for the use of the dead in the afterworld

of bird wings. There were pieces of skin from the sea otter and the fur seal, as well as paddles, parts of wooden slat armor, decorated wooden shields, spoons, and labrets, or lip plugs. Some of the latter were inlaid with shell. There was also a large amount of matting as well as an extensive variety of bags and baskets. Some of this material was in excellent condition; other pieces were partially disintegrated. The woven articles, all of twined construction, showed an infinite variety of design as well as numerous differences in the weaving technique. The best of these are considered the equal of any comparable material from any part of the world.

All the mummies were in the contracted position, with legs close to thighs, chin resting on or close to the knees, hands over or near the face. The abdominal organs of most of them had been removed through the pelvis, one or two through the chest. None of them, however, were stuffed with grass as reported to Veniaminof by the Aleuts. Some Russian accounts state that after evisceration the body was rubbed with oil for many days. Other stories have it that the body was placed in running water in order to remove the fatty matter.

Animal or bird skin parkas were wrapped around the bodies, and some of these garments had remarkably elaborate fringes. Around the parkas were wrapped two or more finely woven mats of varying design. These were covered by a sea lion or seal hide, and the bundle was then encircled with a net of braided sinew. Some of the mummies lacked the sinew net and were tied with a thick, coarse grass rope; a few were tied with kelp.

At the time of the discovery, there was no opportunity for opening the mummies for inspection. On examination at Washington at a later date, Dr. Hrdlička pointed out that two physical types were present. One of these matches the historical Aleut, who are short, round-headed people. The other, a comparatively tall, long-headed people, he thought of as pre-Aleuts. If this physical difference can be related to a pre-Aleut culture, then the practice of mummification must have existed long before the advent of the Russians, who found Aleuts on the islands when they arrived. While it is unknown how the practice of mummification commenced in the Aleutians, it is quite possible the custom may have originated among pre-Aleuts and have been carried on by the later people.

The individual mummy package or bundle was small. In a few cases it was found that bones had been broken, apparently to facilitate the wrapping of a small, neat compact bundle. When we packed the mummies for shipment, we found that with care two adult mummies could be packed in a fifty-gallon herring barrel.

Another large mortuary cave containing mummies was discovered not far distant on the following day. Water dripped from the roof of this cave, and the dirt floor was damp. Consequently, the material found was not, generally speaking, in such good condition as that in the hot cave. Blocking the entrance was a massive boulder that had fallen from above, causing a very subdued light. The cave tapered from high at the entrance to low at the back, broad at the front to narrow at the rear. On the floor were many skulls, some partially mummified, and long bones dragged there by foxes.

Among the numerous skulls picked up from the floor was one that was particularly large. When measured in Washington, D. C., this skull proved to be the largest ever found in the Western Hemisphere. At that time it was the second largest normal skull ever recorded anywhere. It had a cranial capacity of 2005 cubic centimeters, which is over a third larger than the average for modern man (1450 cc.). There was no evidence of giantism, such as would have been indicated by abnormal thickening of the bone, nor were there any signs of hydrocephaly, which would have caused malformation. As there were no other extra large bones in the cave, it seems highly improbable that the skull belonged to any giant. How or why an Aleut developed such a huge skull is indeed a mystery that may never be solved.

Along one side of this wet cave mummies were stacked like cordwood. Added driftwood planks had been placed between the layers of mummies, which were stacked four high—five high if you counted an odd mummy placed on top of the fourth layer. The first or bottom layer was below the floor level of the cave. Twenty-four gunny sacks full of material were gathered before weather conditions necessitated a hurried and exciting departure from the island.

We visited the island again in 1937 and 1938, for the work had not been completed. More material of a similar nature was obtained, though in smaller quantities. Further searching along the shore line did not bring to light any more caves, although we located several rock shelters that had been used for burial purposes.

Again in 1948, the writer once more landed on Kagamil with the Peabody-Harvard-U. S. Navy Expedition. Since 1938, the hot cave had been re-explored by unknown persons; only some fragments of matting and a few other items were found. Limitation of time prevented a visit to the wet cave. It was noticeable that the volcanic activity of the island had lessened considerably during the intervening ten years.

Ship Rock lies in the pass between Unalaska and Umnak Island. Earlier in the season of 1937 an attempt was made to land here, but strong tide races prevented the ship from reaching the rock. It is a difficult spot, and in 1948 two men are said to have been drowned while attempting to reach Ship Rock in a small boat from Umnak. But on the last day of the 1937 season, our second attempt succeeded with unexpected ease.

Here, under a tall leaning cliff, more mummies were found. These had been carefully laid on whale scapulas (shoulder blades) and pieces of whale skulls. They were sheltered from the elements by a sloping wall of driftwood covered with sea-lion hides. Part of this protection had fallen away, leaving some of the bodies exposed to view. Though there were no foxes on this little island, once again the mummies had been despoiled—this time by puffins. Thousands and thousands of these comical birds, often called sea parrots, nest on the rock. They had eaten parts of the mummies and had burrowed in among them to nest.

Altogether from this rock shelter and from the hot and wet caves of Kagamil, some 65 to 70 mummies were obtained, as well as over 200 skulls.

Possibly there are still more caves in the Aleutians where mummies may be found. Records mention some, and rumors tell of many more. Perhaps some of these caves have been sealed forever by earthquakes, which are not uncommon throughout the islands. During the three seasons we spent in the search, many islands were visited. Many a mile was covered on foot over the tundra and along the shore, and many hundreds of miles were traveled by ship. Numerous caves were found besides those on Kagamil and Ship Rock. Some contained burials, some were empty. It is interesting to note that of all the information we gathered before commencing the search, it was only that given by Veniaminof, well over 100 years ago, that proved to be correct.

Without the wholehearted support and generous assistance given by the United States Coast Guard, including transportation to the various islands, these investigations would have been impossible. Indeed, had it not been for the help rendered by some of the officers and men of the cutter "Chelan" in transporting material on their backs over rough terrain, a considerable part of the finds from the wet cave would have had to be left behind.

At the conclusion of the last season's work, Dr. Hrdlička turned to the members of the party and said, "You have seen the like of which you will never see again." This may be only too true.

▼ **Ship Rock**, in the pass between Unalaska and Umnak Island, where additional mummies were found

Alan G. May photo

▲ A large percentage of the population of Zanzibar consists of Hindus and other peoples from southern Asia. Many of them do not cover their faces with the yashmak or black *bui-bui* as do most of the Arab women

▼ The Swahili fishermen go far out to sea in crafts like this to troll for giant horse mackerel and sharks. Dried shark's flesh is one of the staples of their diet

Zan

ISLAND

Wander through its murky al
of the Ancient East, where the
adventure is as unpredictable

By Russell Barnett Aitken

All photographs by the author

In lieu of a magic carpet, our propeller twinkled cheerfully in a tropic sun, as the ground flew out from beneath us and coconut palms whizzed by like subway stations on a Bronx Express. From the air Dar-es-Salaam looked its name, Haven of Peace, with its candy-box Tyrolian architecture, its tidy lawns, and methodically plotted streets. A fleet of native catamarans lay neaped by the tide on a wide beach, while at the edge of the river mouth the hulk of a large ship, orange in its rust, was half submerged where the Germans had sunk it decades earlier.

Little patchwork islands in coats of forest green trimmed with ochre sand sparkled in the turquoise frame of the Indian Ocean as Tanganyika faded into the west. Twenty-two miles beyond the nose of the plane, we could now see the vague outline of our destination—the Sultanate of Zanzibar, a mystic coral isle right out of the *Arabian Nights*.

In this romantic spot on the waistline of the world, a white-bearded

zibar–
JEWEL

s and bazaars on the Threshold
ext sight, the next smell, the next
s the face behind the yashmak

ruler lives amid oriental splendor in a city permeated with the fragrant odors of spice, frankincense, attar of roses, and the stink of dried shark's flesh. His ensign is a red flag, such as means "danger" in America—a proper color for this Muscat metropolis, where veiled Omani women glide by like dark wraiths, and turbaned Arabs carry daggers in their belts.

As if to set the stage for our introduction to Zanzibar, a venerable Arab was traveling as co-passenger. His handsome head was wrapped in the white *kilemba* worn by men of learning and piety, and he wore a *joho,* a black robe trimmed with gold braid, over an immaculate *kanzu.* Craning my neck, I could catch a glimpse of the silver-filigree hilt on his *jambia,* the J-shaped dagger. It was obvious that our traveling companion was V.I.P., and if his beard hadn't been black, I would have surmised that he was the Sultan himself. The contrast between this Haroun al Raschid and the modern aircraft was startling.

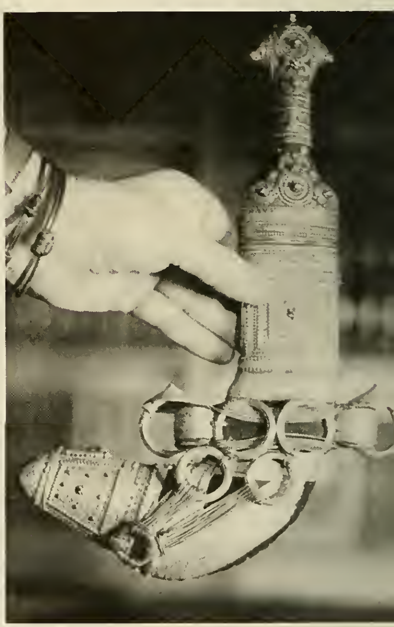
When at last I peered down upon the city that veteran globe-trotters have called the most fascinating in

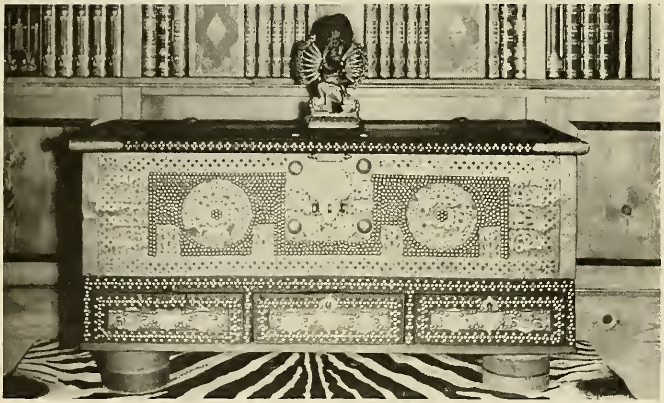
▲ THE ALLEYS OF ZANZIBAR take on a sinister aspect as evening falls. With crime on the increase over Africa, they are unsafe for unescorted tourists. Zanzibar police are efficient, but the town is a labyrinth of narrow streets

▼ ACROSS FROM THE SULTAN'S PALACE, two Zanzibaris were haggling with a Swahili fisherman, critically inspecting his catch as they prepared to buy direct and avoid the middleman

◀ THE BEIT-EL-AMANI, "House of Peace," is one of the most handsome museums in Africa. It houses many interesting relics of Zanzibar's bloody past. Original letters of Livingstone, Stanley, Speke, and Sir Richard Burton are displayed here, as well as craft work and weapons used in many wars

▼ SUCCESSFUL ARABS, men of substance, wear the J-shaped dagger called a *jambia.* Its ebony handle and scabbard are exquisitely decorated in silver filigree. Pure gold threads are used on the belt. Even more than the gorgeous appearance, they prize a blade of age and quality. It is a short, curved blade designed for disemboweling an enemy





▲ THIS IS THE *kasha la njumu,* the "Zanzibar Chest," purchased by the author in the bazaar. It is made of teak with copper and brass overlays and decorative trim of brass nails. These chests were made in Surat, India. Ancient Arabs, distrusting banks, used them for protecting money and jewels

the world, all I could think of was the description of it once rendered by a British resident: "There are worse places than Zanzibar—but not much worse. The place is so windy that tourists are blown right up the beach into the Africa Bar, which serves whiskey with lizards in it. You'll be sorry if you don't visit Zanzibar—but you'll be equally sorry if you do." I was prepared for anything as the plane skidded to a landing.

The town, as we approached it, appeared flat, congested, and dormant in the midday sun; but the instant the airport taxi halted, I inherited a dragoman who popped out of nowhere like a jinni. He was a weathered Arab of indeterminate age, whose pock-marked face radiated emotions ranging from good will to avarice; and he attached himself to me as if a contract had been signed.

I followed him down toward the lapis-lazuli sea. Once outside the labyrinth of choked alleys, I found the town a mass of pastel houses and palms, a tropical garden perched on a sturdy base of coralline limestone, a city resting peacefully in the ashes of a bloody past. Fierce corsairs from the far-off Kingdom of Oman had fashioned her into a domain so powerful and ruthless that a contemporary proverb boasted of it. "When the flute is played in Zanzibar," it said, "all Africa east of the Lakes must dance."

Zanzibar Town is the capital of that once-mighty Empire which today is a protectorate of Great Britain. Its Sultan governs under advice of a British Resident, and its current ruler, Seyyid Sir Khalifa bin Harub bin Thuwaini, G.C.M.G., K.B.E., is an able and just descendant of the royal and belligerent dynasty of Al-bu-Said. His dominion includes Zanzibar and a strip of coast ten miles wide from the Tanganyika border to Kipini, as well as the Lamu Archipelago and a small section near Kismayu. To the humble Moslems of Africa's mainland their potentate is virtually Lord of the World, and his storybook capital represents the Paris and Mecca of East Africa. They do not refer to him as "Sultan," since *sultani* is a Swahili word used in addressing petty upcountry tribal chiefs. Instead they call him "Es Seyyid" ("The Prince").

We wandered past the Beit-el-Ajaib, the House of Wonders, which now holds the Government Offices, and ended up at the Town Palace of the Sultan, an imposing crenellated building, white as alabaster, with iron grille gates and Arabic insignia on the gateposts. In the courtyard a houseboy was polishing brass urns and giant trays which glittered like pure gold. When an armed askari eyed me suspiciously, I took the hint and departed, crossing the street to the quay where two Arabs were haggling with a Swahili fisherman whose catch was still jumping around in his nets.

▲ After a night of tropic rain, the alleys of Zanzibar Town are full of puddles until the hot sun can reach and dry them

Heading for the Bazaar, we turned into narrow alleys reminiscent of the Casbah and traversed a Street of a Thousand Smells, where it was necessary to dive into the sanctuary of a doorway to avoid being run over by bicycles, oxcarts, hand-drawn hamal wagons, and porters with heavy boxes stacked six-high on their heads. Here the heat was oppressive, sickening.

In the cluttered confusion of the Bazaar, wily Hindus hold in contempt anyone who pays the first price asked, and it was amusing to bargain with them. In one decrepit shop I found what I was looking for —a magnificent brass-bound, nail-studded teak chest about four feet long. This was a *kasha la njumu*, the famed "Zanzibar Chest," made long ago in Surat for Muscat Arabs, who distrust banks. It is rated the most beautiful of all the exotic chests of the world, and authentic old ones are scarce and expensive. After making arrangements for its delivery to New York, I prowled the other stores and looked at silver-mounted tiger claws, daggers, swords, silver Koran cases, and dainty filigree jewelry.

It was only when we trekked to the native market that I became fully aware of Zanzibar's cosmopolitan conglomeration. Here descendants of the early Muscatees and their mixed progeny, the Waswahili, rub elbows with camel drivers from Baluchistan, silver workers from Ceylon, Persians, Greeks, Egyptians, Levantines, Japanese, Chinese, Khojas, Parsis, and Goanese. Arabs outnumbered the others. The babel of the many languages would drive any linguist insane. There were Comorian, Mafazi, and dignified Omani aristocrats. Swahili bibis in brilliant-hued *kangas* swiveled their gener-

◄ MOMBASA, ON THE COAST of Africa north of Zanzibar, also falls under the dominion of Zanzibar's Sultan; and his red flag, not the Union Jack of the British, flies over old Fort Jesus. This structure was built in 1593-5 by the Portuguese and was wrested from them in long and bloody wars by the Arabs. Indeed, the island on which the fort stands is called *Kisiwa Mvita,* "Isle of War"

ous hips alongside slim Arab women whose faces were concealed by the inevitable yashmak, while sultry-eyed Indian girls with cameo profiles and priceless gems glittering on their foreheads stared insolently at rakish dhow sailors in tattered silks. Perspiring humanity made a pulsating multicolored mosaic of this Crossroads of the Ancient East.

On the counters of the market a bewildering variety of strange-smelling things were displayed, and customers flocked to fruit stalls heaped high with pomegranates, guavas, sapodilla plums, custard apples, Chinese dates, loquats, pineapples, watermelons, and tamarinds. One popular booth was dispensing betel leaves and sliced areca nuts, a mixture which is colored with *katu* and chewed, with a little slaked lime added, like tobacco.

I followed my quivering nostrils to the fish market, where myriad seafoods were being hawked—giant turtles, squids, horse mackerel, whip rays, repulsive *bêche-de-mer* sea slugs, beautiful parrot wrasses, and streamlined barracoutas. Once not so long ago one particular fish was purchased here for a few pice, only to be immediately resold for 7000 rupees when a superstitious son of the Prophet discerned what looked like a sacred passage from the Koran in its scale pattern. One stall, ostracized and segregated, offered ptomaine by the pound—foul-smelling shark's flesh much of which was obviously rotten. The stench was incredible, and I retreated in haste back to the steaming Bazaar.

My visit had been a spur-of-the-moment affair, but now I wanted to stay a while on this picturesque isle. I had no reservations for the Government Rest House, nor could I hope for help from the limited facilities of the English Club or the hospitable Mission. It was my cicerone, Ali, who solved the problem. He would take me to an Arab hotel, he announced, having assumed that I hadn't read the guidebooks which warn against such practice. Beggars can't be choosers, so I shrugged my shoulders and followed my guide's embroidered skullcap into the maze of alleys once again, until he halted at an unprepossessing door. I entered with misgivings, but it actually took a good deal of salesmanship before I secured lodging; finally the proprietor succumbed to the novelty of having an American as a guest.

My heart really sank when a Swahili boy led me up a dark and creaking stairway to my room. It was a sort of cell, whitewashed once upon a time, with a ceiling of poles imbedded in adobe. The rickety iron cot held a thin mattress that was filthy and yellow with age, and the pillow looked, and later felt, as if stuffed with cornstalks. A cockroach the size of a mouse glared at me from a corner, and the windows faced a slatternly Hindu bedroom almost within jumping distance across the squalor of the alley.

With little appetite left, I descended to the ground level for early dinner, passing two naked children asleep on the floor. My fingers were crossed as the host directed me to an alcove in the verdant patio, where I was startled to find a table set with spotless linen and gleaming cutlery—the sugar, creamer, and fruit bowl being antique silver of a quality to bring an avaricious gleam to one's eye.

I was as pleasantly surprised by the meal itself as I had been shocked by the appearance of the bedroom. The first course, a thick soup, was delicious; and when it was whisked away, it was followed by fish so fresh that they must have left their coral reefs that very afternoon. Next the barefoot boy brought roast chicken, tender and succulent, on a silver salver; and when the dessert arrived, it proved to be a flawless custard in a tantalizing sweet syrup. Thick Turkish-style coffee topped off a repast that would have done justice to a holder of the *cordon bleu.*

Warned by my guide of the dangers lurking in the night-shrouded town, I turned in early. Crime is on the increase throughout Africa, and Zanzibar's murky alleys are made to order for assassins well-trained at quick dagger thrusts.

A misty moon was sneaking out from behind a curtain of palms as I crawled gingerly between threadbare sheets, while on the ceiling directly overhead a gecko lizard inspected me sardonically. Outside, the humid night was a cacophony of strident sounds. Urchins and stray dogs fought in the street below, and the caterwauling of a drunk in a near-by bar blended with the bawdy, high-pitched laughter of some dusky demoiselle. Wafted on a vagrant breeze from the native village of Ngambo, the muffled throbbing of drums told of an *ngoma* in progress. As if the bedlam were not sufficient distraction, an extemporaneous peep show, clearly visible through the unshuttered windows, was taking place just across the alley. It was long after midnight when black clouds unzipped in a deluge of torrential proportions to quiet the seething metropolis like a sorcerer's cloak. With the elements drumming a tattoo on the corrugated iron roof, I finally dropped off into a disturbed slumber, my wallet under my pillow and my door double-bolted.

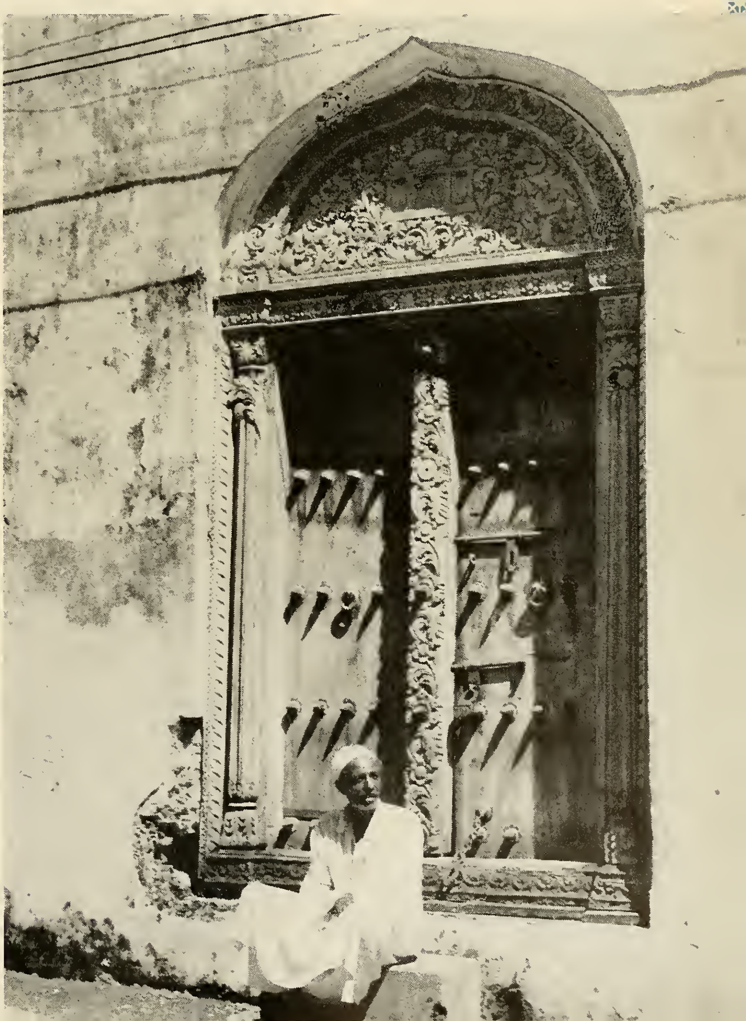
In the morning a blinding sun beat down upon the rain-washed city, and the air was fresh and fragrant with the aroma of spices. My watchdog, Ali, was patiently waiting on the stoop; and after a leisurely breakfast, I set forth to view more wonders of this diadem of old Azania.

Back in the Bazaar the clank-clank of brass cups announced the arrival of the ubiquitous coffee vendor. These enterprising merchants give curb service to Arab customers, who drink the cardamom-flavored Mocha incessantly. A small wooden cart with solid disc wheels scattered the trade as it clattered past. It was drawn by a miniature bullock, whose zebu hump shifted left-right, left-right, in tempo with its trot. It was followed by an Indian on a bicycle, who halted to ring his bell and shout in Gujarati—apparently a local town crier presenting the morning edition of the news.

Ali dragged me reluctantly from the workshops of the silversmiths to show me the Anglican Cathedral, which was purposely located on the exact spot where the old slave mart had been, its altar directly over the site of the whipping post. Above the pulpit is a crucifix carved from wood of the tree at Lake Bangweulu, under which David Livingstone's heart was buried. In that famous missionary's time it was common to see pathetic lines of shackled slaves staggering through the streets, while their captors paced alongside chanting charms and prices in singsong refrain. His descriptions of the horrors of the traffic proved a powerful factor in enlisting world opinion against the slavers, and the boxlike house on Hollis Road, where he lived while on Zanzibar, is visited by most tourists.

Two commodities, slaves and tusks, played a major part in the history of the island. Black and white ivory were so inextricably woven together that no one knows whether the lust for slaves started the ivory trade or vice versa. The enterprising Arabs of Muscat had been inland to every important spot later "discovered" by European explorers, and while some were legitimate merchants who bartered beads and calico for elephants' teeth, these were outnumbered by a more vicious type. The slave raiders ruled with gun, sword, and torch. Their methods included intimidation, pillage, kidnapping, and mass murder. Once their renegade Swahili cutthroats had surrounded and sacked a village, they would massacre old women, infirm men, and young children, taking the attractive girls back for the harems of Zanzibar and drafting the husky males to carry the stolen tusks looted from the chief's hut. When the half-starved prisoners staggered with their burdens to the coast, their reward was the auction block and a life of bondage and abuse. At one time as many as 70,000 slaves were exported per year, and it has been estimated that ten died upcountry for each one that reached the littoral alive.

Slaves who died on Zanzibar were simply thrown onto the beaches to be taken away by the tide or de-



➤ ONE OF THE MOST TYPICAL objects in Zanzibar Town is the Arab Door, with handsomely carved frame and sharp brass studs. These doors are quite old and were based on ancient Indian palace doors, which were similarly armed with spikes to discourage the attacks of war elephants

◀ A CAT can look at a king, they say, and a mule driver can peek at the Palace of the Sultan in Zanzibar Town

▼ CURB SERVICE in Zanzibar: a coffee seller and his Arab customers, who drink dozens of cups of the cardamom-flavored beverage each day. The clanking of the brass coffee cups announces his arrival

voured by rats, sea gulls, or the packs of half-wild dogs. To ship slaves back to the Muscat homeland, the Arabs packed them sardine-fashion into dhows, squeezing from 200 to 400 onto each vessel. Sanitary conditions were appalling, and in the grim 40-day trip the human merchandise died like flies.

In the old harbor today, dhows still drop anchor. Romantic-looking crafts with lateen sails, they travel 2000 miles on the northeast trade winds, their holds filled with dates, coffee, prayer rugs, and dried shark's flesh for their expatriate kinsmen. From February to April the primitive ships glide into Zanzibar, coming down on the monsoon as they have since the time of Sindbad. At the end of March, the lean brown sailors haul up their plaited grass anchor ropes to make the long voyage home.

Early dhows carried back great cargoes of ivory, for Zanzibar was the clearinghouse for elephant tusks, which were so valuable that they were called "white gold." So ancient was this commerce that in the thirteenth century Marco Polo wrote: "The staple trade of the great and noble island of Zanghibar is elephant's teeth."

From deep in the heart of the Congo, from South Africa, and from far north in Somali country, long lines of sweating porters brought tusks of many sizes and colors. There seemed an insatiable market for "the Pearl of the Forest," and it proved a lure to sportsmen and professional hunters. To the pursuit of elephant for sport or profit came men whose names are now legendary in the annals of big game hunting—Roualeyn Gordon-Cumming, Captain Cornwallis Harris, Charles Baldwin, William Cotton Oswell and later Selous, Finaughty, Sutherland, Neumann, and the greatest of all the elephant slayers, "Karamojo" Bell.

One by-product of the ivory trade was destined to become Zanzibar's most famous son, a black Napoleon of Central Africa called Hamed bin Muhamed bin Juma bin Rajab, better known as Tippu-Tib. This great ivory poacher and slaver was distinguished by elegant dress and a courtly manner, and without his aid the discoveries of Livingstone, Cameron, Stanley, and the German explorer Wissman might never have been accomplished.

In quest of something tangibly connected with ivory and the slave trade, I journeyed with Ali to the Beit-el-Amani, the House of Peace, one of the handsomest museums in Africa. Of modern Saracenic style, it is not far from the center of town, and in it are displayed relics of the sanguine past. There were gold-inlaid muskets and swords, carved war drums of mango wood, and the ancient *Siwa*, sacred horn of Mwenye Mkuu. This mystery man of the Shirazi was as powerful as the Sultan himself, and his crumbling palace at Dunga is reputed to be haunted by the ghosts of victims buried alive in its foundations.

In a glass case in the Beit-el-Amani I found yellowed letters of Livingstone, Sir Richard Burton, John Hanning, Speke, Henry M. Stanley, and other early explorers who outfitted their safaris on the island. Burton, one of the greatest adventurers who ever lived, once recommended that Zanzibar abandon its then embryonic clove industry and plant sugar instead. Were he alive today, he would find that cloves are the mainstay of the Protectorate, which furnishes 80 per cent of the world's supply. Practically anyone who has ever eaten a piece of apple pie or a ham sandwich has bitten into a modest souvenir of old Zanzibar. Much of the export goes to Java, where the spice is used not only in cooking but in smoking. Shredded cloves are blended with tobacco and smoked by many Javanese, who claim that the effect is narcotic and soothing.

The island is not large, being only 53 miles long by 24 wide, and travel outside of town is by bicycle, mule cart, or motor car. There was a sort of Toonerville Trolley narrow-gauge railroad than ran seven miles to Bububu, but that is now defunct. The countryside is tropical in character, and in addition to the clove trees, which grow to a height of 30 to 40 feet, there are coconut palms, banana trees, orange, durian, pipals, mangoes, almond, casuarina, and ilang-ilang. Giant baobabs grow to a tremendous size, sometimes over 70 feet in circumference, and it is claimed that they are so old that no one has ever seen a young tree. In the tilled fields, cassava, millet, sugar cane, Indian corn, sweet potatoes, and eggplant are grown.

Next to agriculture, the most important industry is fishing, and every Swahili is a born sailor. His favorite craft is the *ngalawa,* an outrigger canoe hewn from a mango log, which he takes out in fair weather or foul in quest of fish and turtles. Larger boats manned by many hands are used for trolling for the huge sharks and horse mackerel.

Most numerous inhabitants of the island are the Waswahili, a good-natured tribe who are descendants of early Arab men and black Bantu women. They speak a language called Kiunguja, a type of Swahili heavily interlarded with Arabic. Like their masters, the Waswahili are leisurely, and their slogan, *Kesho inshallah* ("Tomorrow, God willing"), corresponds to the *bado kidogo* of Kenya Colony and the *mañana* of Mexico.

A separate tribe, the Wahadimu, live on the eastern end of the island and claim to be descended from the earliest settlers. They are possibly of Shirazi origin and, unlike some of the coastal people, are kind to their animals and may often be seen leading herds of small Muscat donkeys to the sea for a bath.

The carved teak doors in the town are interesting in the finesse of their execution. When a Zanzibar Arab planned to build a home, he first commissioned a craftsman to carve a beautiful door frame, and the house was then built around the erected lintel. Sometimes the owner's monogram was incorporated in the design; or a stylized lotus might be used as a symbol of reproductive power, or frankincense for wealth, or fish for fertility. The doors are often studded with big brass spikes, patterned after ancient Indian palace doors, which were so armed to prevent their being battered down by the war elephants of their enemies. The present Sultan is considering passing an ordinance requiring landlords to keep the spikes polished. Many shopkeepers hang across their doorway a string of dried mango leaves, a traditional good-luck charm.

The beaches of Zanzibar are white, bordered in many places by low coralline limestone cliffs fashioned into fantastic shapes by erosion. The glamour of the island is enhanced by the fact that on occasion zircons, moonstones, and garnets can be found in the sands of the beaches.

A tropical indolence sets the pace for life in Zanzibar Town, for no Arab likes to be rushed. He is courteous, graceful, leisurely, and by custom eats his food in silence using only the fingers of his right hand. He abstains from alcohol and dotes on sweets, particularly a sticky pink confection called sherbet. Friday is his Holy Day, and the devout pass it in the seclusion of their homes, reading favorite passages from the Koran. Zanzibar was once infamous as a sort of Sodom and Gomorrah of oriental vice, but if this still exists, and it probably does, it is not obvious to the casual tourist.

At midday, tramping the streets is like hiking in a blast furnace, and the humidity is murderous; yet it is probably no worse than a hot August day in St. Louis, Washington, or New York City, and there *is* a prevailing breeze. Unlike the mainland, it has no tsetse flies and relatively few mosquitoes, although malaria was once taken for granted, and all who lived there for any length of time contracted the "benign" type.

By the time I had to leave, I was quite attached to the place. We took off into a wind heady with the scent of cloves, and soon the mosques and minarets of the fairy-tale capital disappeared beyond our rudder. At the Customs wharf at Dar-es-Salaam a native boat was waiting; and with ebony-skinned Swahilis at the oars and myself at the tiller, we headed for the ship. The oarsmen chanted in unison the whole distance, and when at last I scrambled up the Jacob's ladder, I could hear their song lilting happily across the bay. It drifted faintly through my porthole as I spread out the loot from my invasion of the Never-Never Land of Zanzibar.

➤ THE LATEEN sail of the dhow does not lend itself to tacking, and the boat is unwieldy when becalmed. In consequence, the sailors must tow the vessel into a position where it can catch what slight wind there is. Since these boats are built of teak, a heavy wood, this is quite a chore

Some of the strangest dramas of the deep are enacted by the squids—rebel relatives of the sluggish snails—which have become faster than the swiftest fishes in the sea

By N. J. Berrill
McGill University

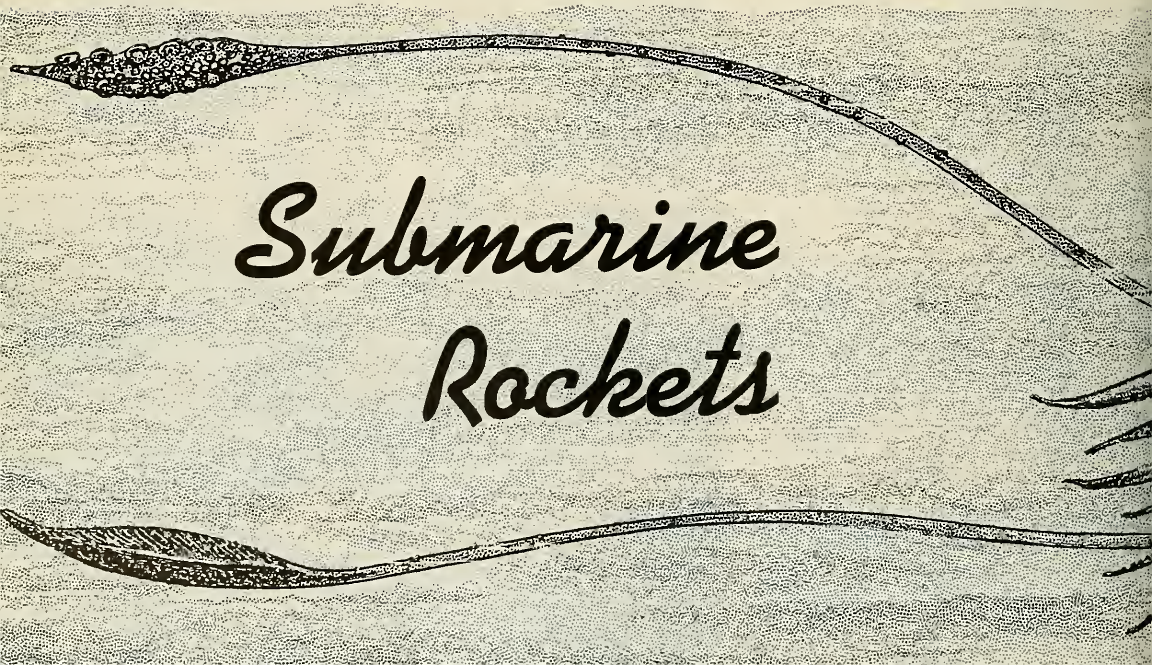
"THIS is the squidiest year I ever twined in" said the Maine fisherman. Off Bailey's Island north of Casco Bay the mackerel seiners had caught 16,000 bushels of squids in their nets in one night. That is an awful lot of squids, and though you can sell some for bait and some for college biology classes, there is little use for squids by the ton. They make a squashed dead weight that breaks nets, and they ooze slime and ink and make a nasty mess generally. The Japanese and certain Mediterranean people eat them, but perhaps the Chinese make the best use of them, drying them for food or piling them up in large vats to wait for the ink to run from the ink sacs. Within the squid there is a translucent shell that is like an old-fashioned pen; ink and pen together are a good reason for the squid's being known as the clerk of the seas.

I had seen squids and squid eggs in aquaria but never in the sea until this year. We were on our way to watch the Memorial Day Parade, and all of us, large and small and all dressed up, took the short cut across the footbridge between east side and the town of Boothbay Harbor. The tide was far out. For a long time now it has been a habit of mine to walk along the edge of rocks, wharves, bridges, or boats to look into the water, as often as not without anything marine in mind. Yet mentally focused or not, my senses respond to anything unusual as sharply as to a silver dollar on a sidewalk.

It was in this way that I nearly missed the parade, and my family would have been more relieved if I had, considering the outcome. In a few feet of water near the bridge was a broad circular band of whitish stuff – something that had not been there a day or two before. It is not always easy to know when a suspicion first arises and when it becomes a certainty, but while I looked and my family went on, the thought of squids came into my mind, and then I saw the shadowy, fleeting figures in the shallows. Squids they were, darting away and then suddenly stopping as they chased and caught small crabs. The white circle was a great mass of squid eggs.

I finally saw the parade in a pair of muddy hip boots, holding an old can containing precious eggs, but I was signaled by my loved ones to stay on the other side of the street and pretend I didn't know them.

The eggs themselves were enough



Submarine Rockets

to show they had been laid within the last day or so, and I went back the next time the tide was low. The great white circle must have been made by dozens of squids, all around the outside of an old tire. Smaller clumps were attached to rocks, but none could be reached in a comfortable manner. It was boots again, wading and sinking in smelly, sucking mud, with water rising about the knees and seeking out the leak in one of the boot tops. None of it mattered much. Most marine biologists seem to have been weaned on mud at some time; they are most at home sliding and slithering and sticking in mud flats. Anyway, the eggs survived the trip back to the aquarium and rock pool that awaited them, and we watched to see if they would hatch.

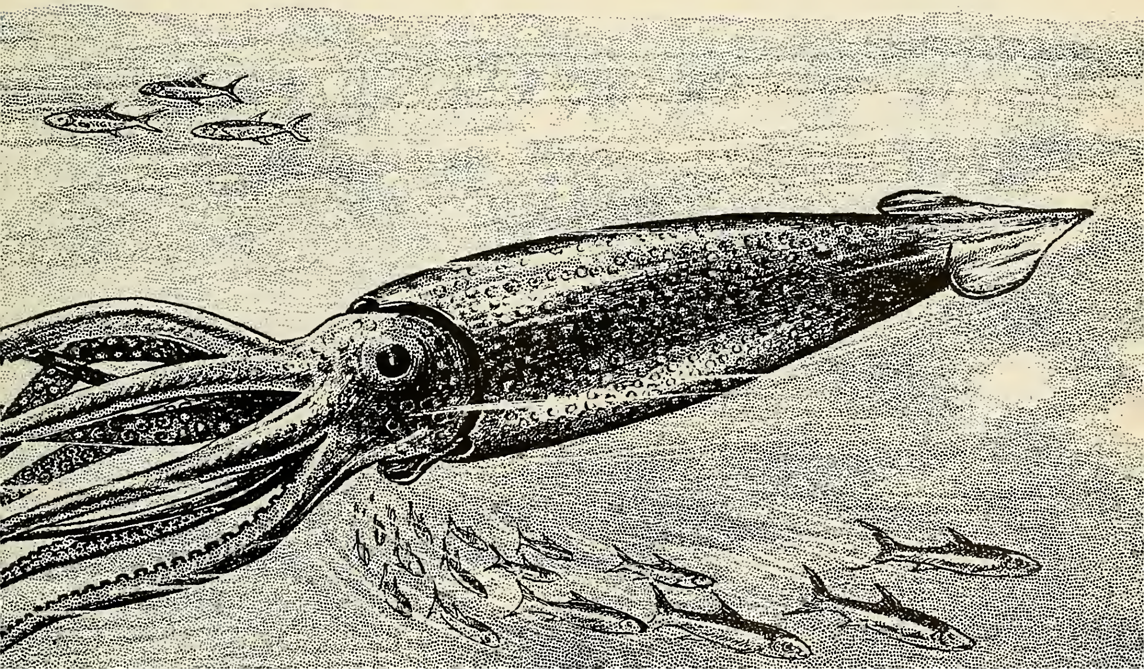
The miracle of the squid is not so much the way it shoots through the water like a living arrow. Rather, it is that squids are mollusks – relatives of the sluggish, heavy-shelled, crawling snails of the sea floor—and yet mollusks that behave in a most unmolluscan manner.

Squids do not swim continuously as fishes sometimes do; but in general they compete with fishes on the fishes' own level. Of the two, size for size, the squids are by far the faster swimmers, and salvage divers swear they are the more intelligent. At the other extreme of their phylum, or tribe, are the equally molluscan oysters, without a head, without power to shift their position a fraction of an inch, forever straining the water that lies within reach for the particles of food it may hold. Both are mollusks, each with a shell, a molluscan heart and gills, muscles and nerves on the molluscan plan, and a system of intake and output of water.

An oyster sits permanently on the spot where it first landed. It has no need to see where it is, for it's going nowhere, and it goes in for thicker and harder shells, wherein lies its safety. In the life of its relative the squid, everything is different. The squid never rests on the sea floor and has lost the lime in its shell in order to lighten the load. It has the streamlined shape of a rocket, for speed is its specialty. And it has a head with all the equipment needed for oceanic navigation and the hunting of prey.

It can do everything a fish can do, but it does it in its own way, with its own unique equipment. It is streamlined for speeding backward, not forward like a fish, and is reminiscent of that mythical backward-flying bird that doesn't care where it's going but would like to see where it has been. It can also swim slowly forward by undulating a pair of fins. But where the fish sculls with a driving thrust of muscle and blade against water, the squid draws water quickly in through the wide mantle opening and then sends it like the jet of a rocket out through the funnel. Some fishes use the water from their gills to aid them in swimming, but the squid is Nature's rocket par excellence.

Its motion is true jet-propulsion. Water is the agency; the bands of muscles encircling the body and the water chamber within supply the power. And none of it was originally designed for travel, for the whole mechanism is, in its basic make-up, the respiratory gill system that all mollusks have. The gills are still there in the squid, lying like feathers in the watery mantle chamber. And because the animal



is a high-speed, energy-consuming living rocket, it needs more oxygen than the oyster, not less. So the gills that collect the oxygen, the blood that carries it, and the heart that pumps the blood are even more efficient. The fish manages to work with one heart to pump its blood through gills and body. The squid does better—one heart for the body and one for each gill, so that the gills run on a supercharge. Rocket-shaped, jet-propelled, with special fuel pumps—it's no wonder speed has been developed.

Yet speed has little value by itself and by itself permits an animal neither to capture nor to escape capture. So we come to that amazing organ, the head of a squid (or an octopus, for they amount to much the same thing). The head is a head-and-hand rolled into one.

Think for a moment about where squids have to operate. Most of the time they prey upon fishes, often far from shore and usually a long way above the floor of the sea. To stay within proper physical bounds it is necessary for them to detect whether they are moving toward the surface or toward the sea bottom. So eyes, of a kind, and gravity organs are both necessary and present. Their gravity organs are simple—little more than sacs with weights in them. Squids, like most animals, have a pair of them buried within the squid brain itself.

Apart from these organs of sight and balance, and the brain within, the head of the squid is a circle of a few long whiplike tentacles, each with its double row of vacuum-suckers to hold with, and a formidable beak at the center where the mouth lies.

* * *

I went down to the pool into which I had transplanted the eggs. Most of them had turned white and opaque and were obviously no longer alive. It was almost as though they were hard-boiled. This was puzzling, for the water was continually freshened by the tide, and certainly it was cold enough. A few eggs, embryos by now, seemed about ready to hatch. But even these died before they succeeded, and it was more than time to go back and see what had happened to the eggs at the bridge.

This time the tide was a little lower, for the full moon had just passed its prime, and I found the eggs without getting a boot full of cold water. The large mass I had first seen was gone, all hatched and gone on their way, but some fresh egg masses had been laid more recently. Two or three reddish-brown squids shot away quickly out of sight.

An old lobsterman in a small skiff pulled over, for a fisherman is as curious as any boy. He asked what I was doing. Any marine naturalist knows well enough to expect almost any question or comment, for as a rule he is caught doing something peculiarly silly in some place where every fisherman knows there are no fish. And when you are told, "You can't catch fish there," or "Shrimp is over there," it seems either rude or imbecilic merely to wave, smile weakly, and go right on with what you are doing. You do get hardened to it, as I suppose a painter gets used to a crowd of kibitzers.

"What have you there?"

"Squid eggs."

The old man was at once eager to see them. I was a little surprised he had never seen squid eggs before; but after all, this really was the squidiest year, and probably I was in more luck finding them than I realized. He looked at the eggs and looked at the water. The tide was dead low, and I could just manage to wade to the eggs without boots.

"It's fitting, isn't it?"

I asked him what he meant. He looked again at the tide. The eggs are safer close inshore, he said, but how do the squids know enough to lay them where the tide won't leave them high and dry, right at the very edge? The only answer I could think of was that the squids might wait for low tide and then lay their eggs as close to shore as possible. It could be true. And, he went on, everything in the living world but man seemed to fit; it all made a pattern, though he couldn't see what the pattern meant.

The near-by boulders beneath the surface of the water were festooned with the eggs—with hundreds of cigar-shaped masses of jelly, each about the width of a pencil, each small mass containing 50 to 60 developing eggs. I took as many as I thought I needed and put some again in the pool, the rest in the aquarium. This time there were eggs at almost every stage of development, and at least I wouldn't have to wait for weeks for some of them to hatch. The embryos were held secure in the fingers of jelly, though each one had its own small compartment in which to become a squid. Each egg, in fact, lay within a small spherical capsule filled with fluid, and it was these capsules that the jelly actually held together.

Few people have ever seen squids either mating or depositing their egg masses, and I doubt if there has been anyone who has seen both activities. It is a rather complicated business, not so much because the sexes are separate and are not combined in the same individual as in many snails, and only partly because the eggs must be fertilized before they get all wrapped up in jelly. These are factors, of course, but it is the combination of these with the free-swimming life of the animals in the open ocean that makes things rather difficult. Most of the whole pointed end of a female squid is set aside for the production and ripening of eggs. The jelly is added to them as they are passed out of the oviduct into the gill chamber, just before they are deposited. And to develop they must be fertilized on the way. That means sperm must be there in the right place at the right moment. So we come to the male animal.

Squids of both sexes have ten arms. Eight of them are moderately long and correspond to the eight arms or tentacles of an octopus. The other two are much longer and are used more like hands in the actual capturing of animals for food, as distinct from holding them. Now, it would do no good for sperm to be shed freely in the water. It has to be ready for use in the mantle or gill chamber of the female when her eggs are ready. Even if the water carried sperm into the chamber, the chances would be remote for the eggs to be fertilized. What happens is this. The microscopic sperm cells are made up into small pencil-shaped packages called spermatophores, each about a half inch long, in a special gland possessed by the male. As these packages accumulate, the male inserts one of his two long arms down into his own gill chamber, grabs a handful of sperm packets, swims alongside a female, and shoves the collection into her mantle chamber. Or he may deposit them in a special pit beneath the mouth in a membrane that surrounds the mouth. Later, perhaps very much later, when the eggs are ready to be laid, each packet explodes inside the female, to liberate a cloud of sperm cells, which fertilize the emerging eggs. By this time, of course, the independent male may be several hundred miles away chasing a fish or a crab.

The eggs in the pool began to turn opaque and white again, like the first lot. It didn't matter very much, for the rest in the aquarium seemed to be healthy enough and doing their best to develop a head and a heart. But it was puzzling, until I remembered something I suppose I had known all along. It wasn't a matter of temperature or oxygen. Embryos lived happily for hours and even a day or two in a little more than a drop of sea water on a glass microscope slide with a glass cover. If they had been sensitive, they would either have been asphyxiated or had a heat stroke. It wasn't the temperature of the pool that coagulated the eggs, or the heat from the sun. It was the light of the sky itself, north light if you like. And not the light you see. A simple check showed this, for a sheet of glass placed between the eggs and the surface of the water put a stop to the cooking process.

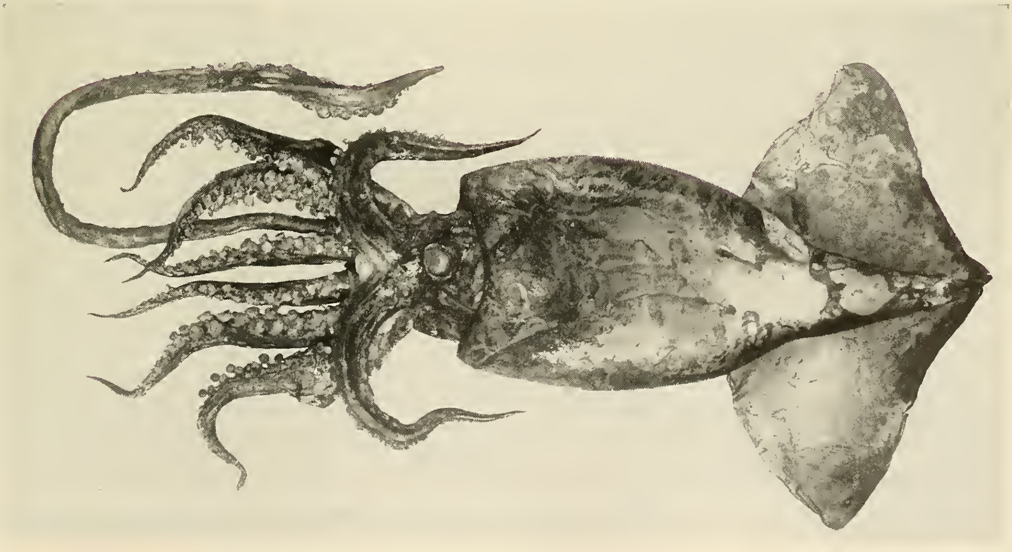
The difference between the eggs in my pool and the ones I had left where I found them was in the amount of water that covered them. Even at low water there was several times as much water overlying the spot chosen by the squids in my pool. And most of the time it was very many times more.

You do not get a sunburn because the sun's rays are warm. Neither do you get it from the white light you see. In fact, you can get as good a burn as any in a nice, thick sea fog. The light that burns is invisible, though a bee can see it; it is the ultraviolet light, which lies just beyond the blue end of the spectrum. This is the so-called black light, and there is a long and important story behind it, for it has entered into the original creation of life on this planet. It is potent, dangerous light, and living things need to protect themselves from it. On land they guard themselves with pigment—skin coloring. In the sea they stay away from the surface. What I had done was to bring the eggs too close to the ultraviolet light pouring in from the heavens. Glass stops it, and that was all they needed. Even the intense light from my microscopic lamp did them no harm, in spite of its powerful condenser, for there was glass between them and the invisible death rays.

At first I could see little in the egg. Then after a few days a thick film spread over the egg from one of its ends and slowly formed a sac of tissue around the yolk. And as this went on, the first end began to thicken, and gradually I saw an embryo taking form—a small round

THE SQUID has a tubular body and ten arms that trail behind when it rockets its way through the water

AMNH photo



body and head. Long before very much of the yolk was used up, the colorless embryonic eyes grew out as striking objects. The microscopic heart could be seen beating within the body, and the ten tentacles were reaching along the sides of the sac of yolk.

Long before the embryo has power to act, the whole egg in which it grows starts to glide and turn slowly about in its liquid spherical prison, with the seemingly effortless ease of a dirigible. As a matter of fact, you can see the same thing happen early in the development of a frog's egg. In both instances, the outer layer of the developing egg acquires a virtually invisible coat of fast-beating hairs that cause it to turn and slide through the liquid surrounding it. The movement seems to be important in bringing sufficient oxygen to the surfaces of the embryo.

After a while the embryo begins to grow quickly, and the yolk is used up just as fast. Then for a time the growing embryo seems to be holding its yolk sac to its mouth with its arms, for all the world like a baby with a feeding bottle. Finally, when the unborn squid has become a little cramped, it takes to the habit of holding onto the walls of its capsule with its fins. The bottle of yolk is just about disappearing into its mouth, and the little creature has developed gleaming colors, when the prison walls soften and break—and the youngster swims out.

I doubt if there is anything more entrancing and more beautiful than a newly-hatched squid. This sounds hard to believe, but everyone who has seen one has had the same feeling. It is tiny, dartingly active, almost all eyes, but above all it is covered with innumerable small patches of color—red, yellow, green, black—not in a set pattern but each flashing, large and small, to make the creature a scintillating jewel of tiny life. My baby squids were only one-eighth of an inch long when they hatched, and when I set them adrift in the sea, I certainly wished I could follow them on their adventures.

A DESERT WALKING STICK

Now you see it, now you don't—as Nature's living twig defies the sharpest eye

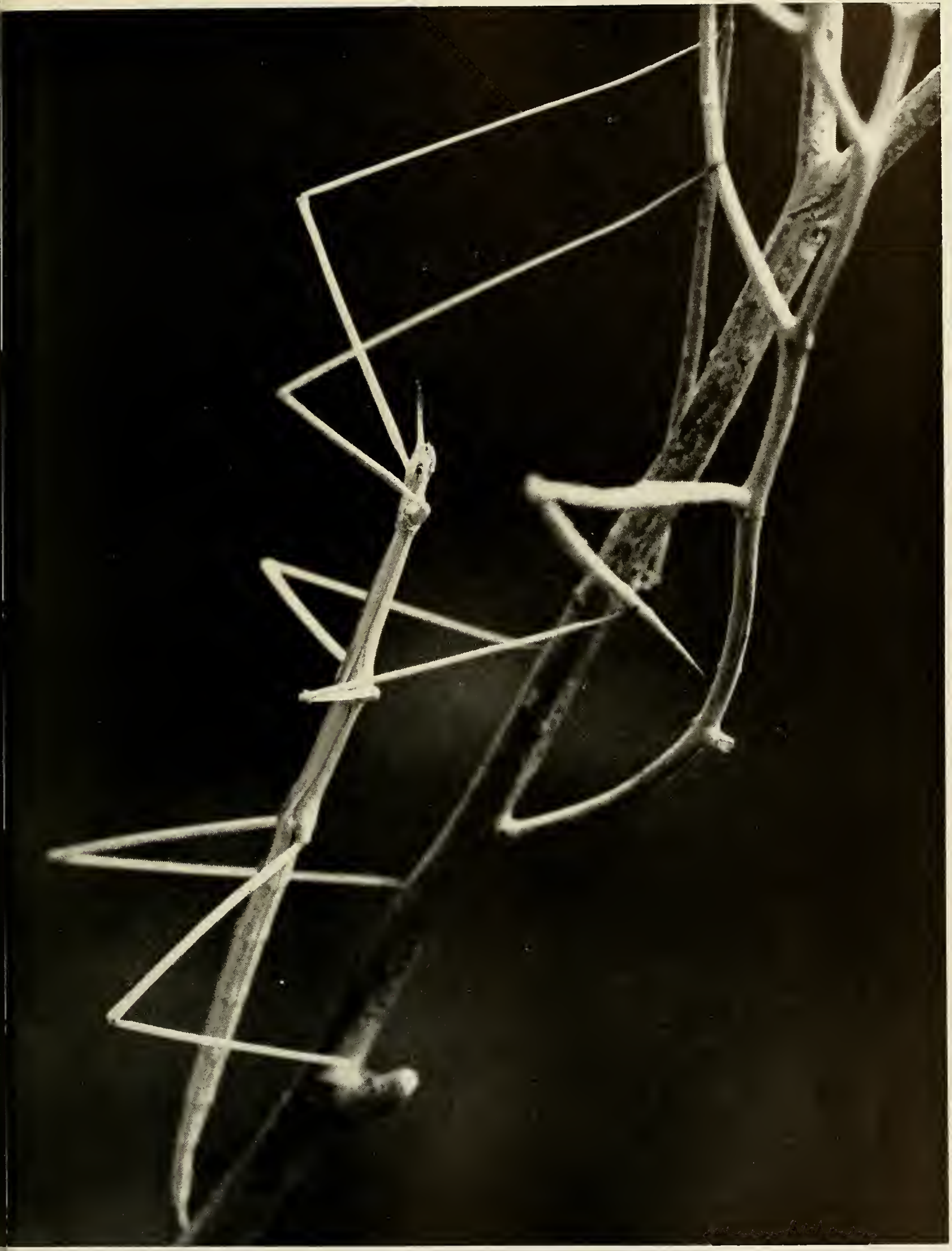
By Lewis Wayne Walker

WE were in Lower California's Viscaino Desert when we saw this insect, on the road between the Onyx Quarry at El Marmol and Bahia de Los Angeles on the Gulf of California. We were having to disconnect the moving parts of the front wheel differential, and night had settled before our work was completed. From all about us, there was a cacophony of sound as myriads of unseen insects tuned up for their evening chorus. Some of the more phototropic were drawn as though magnetized toward the rays of our Coleman lamp. But the thing that caught my eye was a twig walking across the blackened sands beneath the car. While in motion, we could see that it was alive; but in repose, it could have been a bit of straw dropped by the desert winds. As we watched, the horizontal matchlike body crouched low to the oil-stained surface, then lifted itself about an inch above the ground and, with stately, measured tread, walked away. Upon the oily ground, this desert walking stick was a conspicuous white on black, but the moment it reached normal sand, it simply melted away. It became so nearly invisible that we could hardly follow its course to a silvery-gray smoke tree.

As this living twig cruised about the angular thorns and branches, it became with each motionless stop just another bit of the plant swaying with the breeze. It was a perfect example of protective coloration and form, from its angular legs, replaceable if damaged, to its thicker body, which matched the heavier limbs. A single tap on a twig—our imitation of a bird alighting—brought about a complete and instant rigidity, which made the walking stick and the smoke tree one and the same thing.

➤ WHERE DOES the twig end and th walking stick begin? The creature is s well camouflaged that in nature you ma look squarely at it without seeing i

Photo by Lewis Wayne Walker



A DESERT WALKING STICK

Let's Make the Desert Yield

In a hungry, crowded world, the vast and silent deserts have mocked man's efforts to expand his horizons. But the lessons of primitive people reveal that these areas may be an important source of agricultural wealth

By Raymond B. Cowles
Professor of Zoology, University of California

Photographs by the author

THROUGHOUT the world millions of square miles of desert lands erect barriers of drought against human use and occupancy. Even in our own country much of the Southwest lies barren, lonely, desolate, and silent but for the whispering of wind through the sparse brush and an occasional sound of animal life.

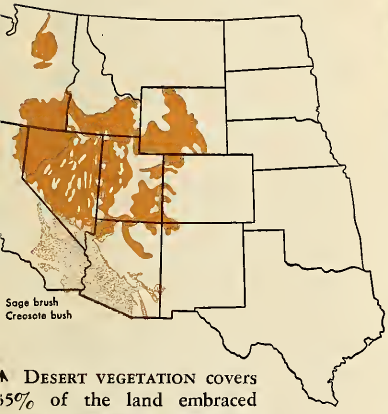
Here and there on deserts, irrigation projects have reclaimed the usually immensely fertile soil, but these man-made oases in their totality represent but a mere fraction of a per cent of the deserts as a whole, and yet the world is clamoring for food. And so we have the spectacle of a rising tide of humanity along the periphery of deserts, a potential human flood of hungry and land-hungry humanity pausing on the brink, held back while awaiting a solution to the problems con-

▼Over wide stretches of arid land the farmer is constantly frustrated in his attempt to get enough water for traditional kinds of agriculture. Falling water levels are forcing abandonment of once valuable farmland

fronting it. Expansion of irrigation from underground water resources is approaching an end; in fact, in many areas falling water levels are forcing abandonment of farming, and for most areas irrigation can be had only at enormous, probably economically impractical, costs.

For the past century, expanding populations have forced man to farm progressively more marginal land, to creep upward onto less fertile hill slopes and into semidry prairies. Elsewhere swamps have been drained and rivers have been banked and channeled to permit farming. Almost all lands of high agricultural worth have already been put to use. Only along the desert edges has the human tide been checked by the terrible aridity.

After U. S. Dept. of Agric. Misc. Publ. 670



DESERT VEGETATION covers 5% of the land embraced y eight western states—an rea more than four times the ize of New England

Because of the drastic need for more food and more room, these vast desert areas confront us with a very real challenge.

We are impelled to search for ways of putting them to use; yet present conventional methods and thinking are making no progress. Only a totally new approach can devise the means for the general utilization of desert lands. Irrigation and artificial rain-making can never provide enough water for a widespread agriculture employing the crops with which we are familiar.

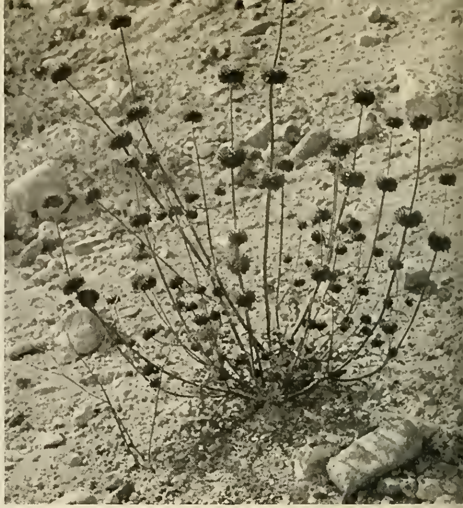
▲ OVER THOUSANDS of square miles of desert, there is enough rainfall to support considerable native plant growth. Among them are scattered edible species or others endowed with strong flavor, pungent oils, and possibly medicinal ingredients

Therefore, in order to put these wastelands to widespread use it will be necessary to discover new crop plants—plants already adapted by nature to the drying winds, burning sun, and infrequent rainfall. There are many such plants, and it seems reasonable to expect that at least some of them might prove to be valuable assets in desert areas. Only by widespread exploration will they be found; and following their discovery, experimentation must be conducted in order to determine their economic utility.

Although their discovery might at first appear to be difficult, there is already a great body of information that can expedite the search—the experience of native peoples who have dwelt in the deserts around the world. In all of the world's arid regions there are people whose whole economy—food, clothing, even drugs—has come from native plants and animals. But for the most part these people have not practiced agriculture, except in the loosest sense of the word. Therefore, they have not systematically developed the especially valuable strains. Nor have desert plants been adopted into the agriculture of more advanced cultures, with extremely rare exceptions.

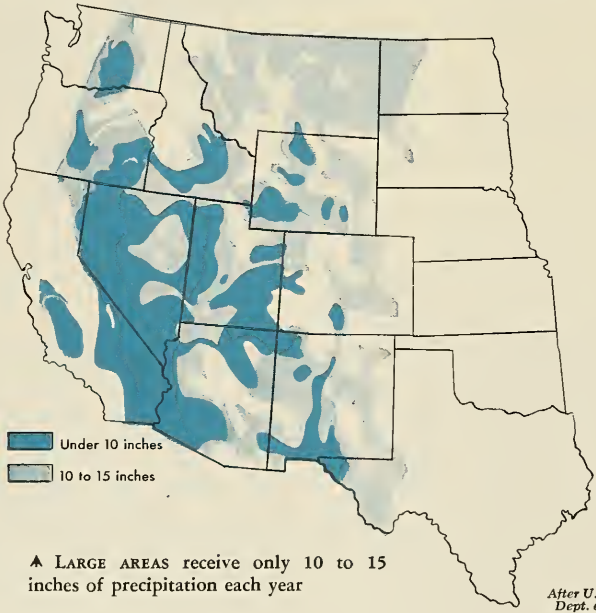
In our own deserts the ethnobotanical records indicate that there are scores of food-producing plants that in the wild, unimproved state supported populations of many thousands of Indians. Among these hitherto unexplored resources alone there may be many types of plants suitable for a real desert agriculture. If to these are added other species used by natives of other deserts, we should have hundreds of plants from which to choose those best suited to our

▲ Perennial bunch grasses produce heavy crops of edible seeds and are important to the stock grower. Selected varieties, grown in pure stands, might reclaim many desert areas



▲ The seeds of Chia, a desert-loving mint, are nutritious and delightfully flavored. In pure stands they could be harvested by machinery

needs. To the natural question as to whether or not systematic studies, including plant introduction, genetic and crop production research would be justified, the answer is an emphatic yes! Among the truly desert crops, there are bound to be many suitable for growth in marginal lands having greater rainfall, though not enough to support regular kinds of agriculture. There are great areas of these marginal lands that now support only a precarious agriculture. Throughout these regions the vain hope prevails that the rainfall in any given year will be above average and thus produce crops that will recoup the losses from previous years of drought. Although economic conditions frequently stimulate farming, the soil itself usually suffers, and the net result is of dubious value. It is entirely possible that the cultivation of drought-loving plants in these areas would reverse the usual crop failures during dry spells and substitute crop success *except* during years of exceptional rainfall!



▲ Large areas receive only 10 to 15 inches of precipitation each year

After U. S. Dept. of Agric. Misc. Publ. 670

Among the many useful or interesting plants already known to exist in our deserts can be mentioned a few samples, such as the native tobaccos, which have a delicate fragrance suggestive of Turkish varieties. On hundreds of thousands of acres there are the bunch grasses, so useful to the stock raiser. Among them are species known as dropseed, which are perennial and frequently produce crops of small grains that weigh down their heads. These were used for food by the Indians and might again come into use. Of especially great interest is the chia. This is a mint that grows under a very wide variety of conditions, possibly because it was unintentionally distributed by the Indians, who rated it as a staple article of diet. The seeds were used in cakes, as a flavoring ingredient, as a "mush" (because of an interesting mucilaginous property), and

▲ THE JOJOBA, or goat nut—one of the most promising of our desert plants. Its nut contains 50 per cent of an oily wax of high quality. It is useful as food and in a variety of products from candles to printer's ink

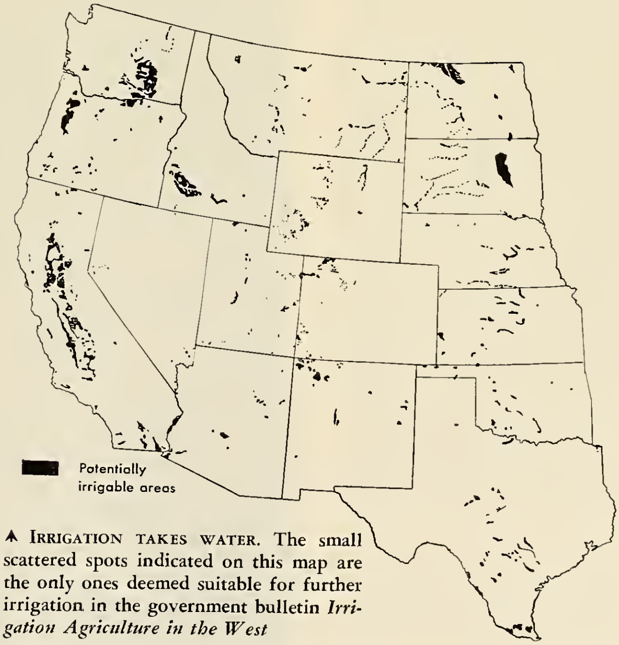
also for the production of a refreshing beverage. It is highly nutritious and should be easy to harvest with regular grain-harvesting machinery. In addition to these items there are plants that produce beautiful natural dyes; others yield strong fibers, aromatic oils in great profusion and variety, and vegetable fats and waxes that rival sperm oil in their characteristics. There are an unknown number that produce insecticides, insect repellents, rodenticides or repellents, antioxidents, antigerminants, possible weed killers, and many very interesting toxins and drugs that might prove valuable in the treatment of human disease.

Because these native plants already proffer so much of interest and potential value, and because we can expect to double or triple the number of useful desert plants by means of exploration and the introduction of foreign kinds, the prospects for developing a genuine agriculture seem thoroughly assured. When we consider the almost magical results already achieved through genetic studies and selective breeding, it seems surprising that we have not yet created specific foundations for the study and development of a true desert agriculture. The guideposts leading to the most promising plants have long since been seen and understood by a small number of ethnobotanists, but on the whole the opportunities have been ignored.

There is a natural tendency to disregard or reject the discoveries of more primitive cultures. This has been particularly evident with respect to medicinal plants, although of recent years there have been numerous instances in which, in spite of earlier disappointments leading to skepticism, some of the plants known to herbalists of old have been reinvestigated and resurrected for present use.

Some centuries ago a Chinese herb doctor discovered that extracts from a beautiful feathery-leaved plant alleviated the symptoms of certain types of allergies. Only comparatively recently this drug, ephedrine, from the scorned pharmacopoeia of an oriental herbalist, was adopted into our own medical practice. Much later, another herbalist in England was reported to have a drug that performed miracles in the treatment of certain heart diseases. Today that drug, digitalis, is still saving the lives of millions of heart sufferers even though the exact manner in which it produces the desired results is scarcely understood.

About the time that some of the early medicinal herbs were being used in primitive fashion, the Indians of our own continent were experimenting and selecting native



▲ IRRIGATION TAKES WATER. The small scattered spots indicated on this map are the only ones deemed suitable for further irrigation in the government bulletin *Irrigation Agriculture in the West* remedies. Among these is one that has only recently come under scientific experimentation. Long ago, the Indians in some parts of our West were using an herb that seemed to have an effect in regulating conceptions so that there could be some timing in the births of their infants. Today this plant, *Lithospermum ruderale,* is being studied by biologists and pharmacologists in order to discover whether or not the Indians really had a drug plant usable for this purpose. It seems probable that there actually is an active principle as reported, but there is still some argument as to whether it works through the master gland, the pituitary, or directly on the reproductive organs themselves.

Every race has, or has had, its pet native remedies. Most of them will probably prove to be disappointing, and all will have to pass careful tests. But the discovery of even one drug as unique as digitalis would be sufficiently rewarding to justify the tedious and expensive procedures required for its development. There is reason to believe that, like other peoples of the world, our own Indians used many effective plant drugs. In their religious ceremonies they used tobacco, a plant discovery that has been worth many millions of dollars in the trade of the world, and they also used Jimson weed, *Datura,* a plant allied to the one from which we extract atropine. They also employed several members of the aster family, one of which apparently contains a nerve stimulant sufficiently potent to cause nerve tremors when smoked to excess. Among the closely related sagebrushes, the Indians also had favorite medicinals that served them as insecticides, balms, hair tonics, cathartics (both mild and vigorous), febrifuges, and even headache remedies. The ornamental milkweeds served similar purposes; and since many of these plants are poisonous, it is not surprising that the Indians put them to use, nor will it be surprising if modern science finds some to have real value. It was from primitive cultures that we lifted some of our time-honored drugs—castor oil, cascara, croton, and others, quinine from cinchona bark, curare and digitalis, opium and ephedrine, and a long list of other valuable substances. All of these were originally discovered by accident, by primitive people. Could scientific methods proffer hope of making equally valuable discoveries? Certainly it would be preposterous to assume that all has already been discovered.

It will not be necessary now to pursue the dreary trial and error methods that our primitive ancestors followed, often at considerable peril, to benefit from our plants. Future developments might follow a pattern suggested by more recent discoveries of the so-called miracle drugs from the lowliest of plants, penicillin, streptomycin, bacitracin, terramycin, subtilin, and aureomycin. Equally interesting is the discovery of animal-like substances such as cortin and ACTH in *Strophanthus* or in yams, the female sex hormone in pussy willows, and the fungus ergot.

The pathway to new discoveries may be shortened by turning our attention to the deserts where so many plants must possess protection from a multitude of enemies. Wherever food supplies are scarce, particularly as in desert areas, every source of sustenance becomes a target for all the local creatures. Plants that are to survive must therefore have protection from the animals capable of using them as food. Those that survive best are those endowed with the best protective devices. Abundant thorns, spines, and hairs are among the most obvious of these devices, but equally numerous are vile or bitter flavors, pungent oils (apparently many of these are highly volatile), and many other types of repellent properties. It should be chiefly among the thornless—that is, in those having the more subtle defenses—that

➤ THE LUXURIANT FOLIAGE of the Coyote Melon, or Wild Gourd, can be seen in many dry, inhospitable wastelands of the Southwest

➤ WHEN IN BLOOM, the Joshua tree presents a beautiful spectacle and promises better grazing for the stockman

⮟ THE JOSHUA TREE'S heavy blossoms are creamy white and exude a fragrance reminiscent of fresh mushrooms. The desert Indians used the buds as food

the most interesting discoveries should be expected. These species might be expected to wage their defensive wars by chemical means.

Millions of dollars have been spent in the search for useful foreign plants and in their introduction. Many of these new plants have been introduced from tropical and subtropical climates and would therefore be unsuited for cultivation over much of the United States. Other millions have been well spent in the genetic improvement of wild crop plants such as cranberries and blueberries and in the development of new varieties of plants already having a long history of cultivation. In contrast to this, there is a remarkable absence of experimentation with plants that grow practically in our back yard. These plants already are adapted to the rigors of life in regions that have not been utilized. This almost total absence of a systematic search for the hidden wealth of our own deserts is a surprising revelation of shortsightedness and preoccupation with conventional procedures. The day is not far distant when we may need to use all of our natural resources to their utmost. In most of the world there is already a dire need for more resources. It would seem advisable to get an early start on the problems of true desert agriculture and thus anticipate our future needs.

We have already noted how often desert plants have strong odors or essential oils. Just how many of these are of potential value and are now going to waste while we import others, cannot be known until additional investigations have been carried out. But we do know that there are vast numbers of fragrant plants that owe their pungency to volatile oils in stems and leaves. Some of these plants are so heavily charged with oils that merely brushing against them leaves the clothing redolent with their odors. One of these, *Thamnosma,* like many others, is so supercharged with oily glands that crushing the stem releases a large quantity of strong-smelling substances. Among the numerous members of the mint family there may be plants that could produce flavors useful in perfumes or as additives in medicines and liniments or in dentifrices. In addition, it may be remembered that according to Indian beliefs some of these plants had analgesic, anodyne, and other valuable characteristics.

That the deserts and semideserts of the world are capable of producing useful food plants has already been shown by the successful introduction of some interesting ones, which may come to be as fully appreciated here as in their native lands. Not many have been introduced, but there are enough to suggest that more thought should be devoted to the development of our own food-plant resources. From the Mediterranean region we have introduced the locust—St.-John's-bread, or Carob—and it is widely grown in Southern California. It is now used only as a shade and ornamental tree, in spite of the fact that when it is mature it is known to produce one of the highest food yields per acre of any plant known. The nutritious and tasty pods furnish an abundance of good food for both man and his grazing and browsing animals.

The almost complete neglect of another plant, a North African desert tree known as *Argania,* is surprising, because it is potentially exceedingly valuable. This tree, which reaches a height of 40 feet with a trunk as much as 18 inches in diameter, produces an abundant crop of olive-sized fruits containing a high percentage of edible oil. Because of the great need for good vegetable oils, it is surprising that only the olive tree has been adopted extensively in this country.

It is just as surprising to learn that one of our own plants, a native of our semidesert areas, has been equally neglected. This is the jojoba, the goat or sheep nut, which is scarcely known beyond a very small group of botanists and chemists. The fruit of the jojoba is a nut about the size and shape of a hazelnut but with the advantage that it requires no shelling. It is relished by both man and his animals, and the foliage provides excellent browse for livestock. Because of this double value, this plant should be thoroughly investigated. It is hardy and drought-resistant, and it grows wild in an enormous area extending from the western parts of Texas and the Del Rio country, westward into California, and southward into Mexico. Even as it exists now, with no improvement, it might be an exceedingly useful addition to the agricultural plants of other areas where the native populations suffer from water shortages and also need to supplement their diet. The plant is attractive in appearance, with a grayish-green foliage and inconspicuous blossoms; and because of its hardiness and food-producing capacity, it might flourish in some of the soil-depleted areas around the Mediterranean, possibly in Greece. And because of its usefulness and beauty as a boundary plant or hedge, its testing might be undertaken rather easily.

The jojoba nut contains almost 50 per cent of an oily wax. In ancient times this was used as a food, a hairdressing with supposedly tonic properties, and an eyebrow restorer, and it is now known that after extraction of the oily wax, the residue from the nuts makes a good stock feed.

The liquid wax has evoked so much interest that several fairly extensive studies have been undertaken. These have led to the discovery of several products such as hydrogenated wax, which makes excellent candles with a high melting point—a most useful characteristic in hot climates. More recently it has been discovered that the oil has antioxidant properties that might make it useful as a shortening in place of, or mixed with, other fats that tend to become rancid. It is of considerable interest to note that another desert plant, one of the most widely distributed of all, the creosote bush, *Larrea,* also produces an antioxidant. It may be that desert plants in general will show this characteristic, a possibility that is worth investigating.

The jojoba liquid wax is useful in printer's ink, and when purified, it serves as a lubricant for delicate instruments. It can also be used as a substitute for carnauba wax, with which it ranks in hardness and utility. It has even been suggested as a substitute for coffee, although this expedient of the old-timers is not recommended unless coffee even exceeds its recent fantastic price level. All in all, this valuable resource, common to California, Arizona, and Mexico, has been little used. Because of its surprisingly versatile uses even in its unimproved natural-growing condition, it is certainly worthy of thorough study.

Experimental plantings and initial experiments on the jojoba by commercial concerns have unfortunately been terminated. A possible explanation is the slow growth of this plant and uncertainties as to the ultimate cost of production, including labor costs. This is an excellent demonstration of the need for co-operative ventures where very long-term experiments are necessary and of the value of private, state, or even federal co-operative research.

Another plant that might prove to have great value in desert agriculture is the desert wild gourd, or coyote mellon. It is reported that the Indians used the seeds of this and related species of gourds as food and a source of oil. When raw, the seeds are exceedingly bitter, but the Indians may have known how to eliminate this characteristic. It has recently been reported that seed production from naturally growing plants may reach from 700 to as high as 3000 pounds per acre, with oil and protein content around 34 per cent each. From an interesting technical report on these gourds it appears possible that even on unirrigated and now barren desert lands it might be possible to produce oil in quantities rivaling the peanut and soybean under good conditions.

Altogether the food plants that might be grown in desert and semidesert country make an imposing list of excellent prospects for experimentation, and the list includes a number of foods that seem delectable even to the beginner. Among these are wild onions, the starchy bulbs of the Mariposa lily, the brodias, and the camass. These and many more are nutritious and easily prepared. Another group of plants not distantly related to the lilies are the agaves and their relatives, including the yuccas and the grotesque Joshua trees. There are several species that are useful as human food and also valuable as stock food. Less well known is the fact that the seeds of the Joshua tree and other yuccas contain good quantities of vegetable oils that might become of value as an article of diet.

Wonders have been accomplished in producing giant blueberries, huckleberries, and other fruits with heightened flavor, production, and hardiness. Modern agriculture depends upon the genetic studies that have produced improvements of this sort. There is little reason to doubt, therefore, that with selection and breeding, similar miraculous results can be achieved with the wild plants capable of growing on some of the greatest areas of waste space now confronting man on this rapidly overpopulating world.

The discovery of even one native desert species of plant that would make cultivation of the desert a profitable venture would pay enormous dividends on the necessary investment in research.

Photo by U. S. Army Signal Corps

Carrier Pigeons
IN THE POLAR REGIONS

The bird that has won battles and carried the mail proves itself equal to new hazards in rescuing stranded polar explorers

By Malcolm Davis
National Zoological Park

WITH the increasing military importance of the polar regions, dependable methods of communication between reconnaissance parties and a home base or ship become more and more vital. Suppose a party is out on the polar ice. A storm comes up; the party becomes bewildered and loses its way. Then something goes wrong with the radio equipment. What can be done in this anxious moment?

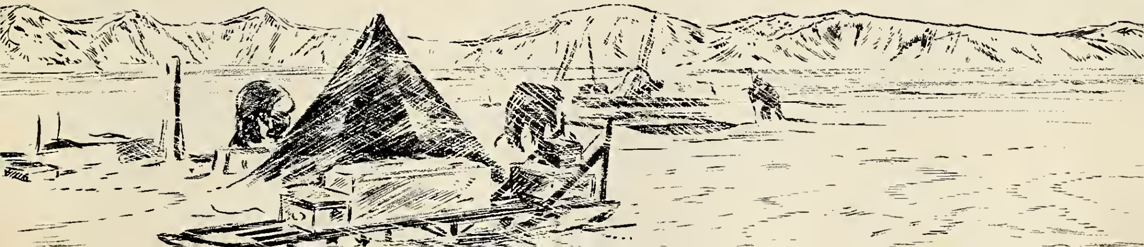
It occurred to me that it would be important to find out whether a carrier pigeon could re-establish contact with the base camp under such circumstances. Even in the unpredictable polar weather with its subzero temperatures, perhaps even among unfriendly birds of prey, I hoped the carrier might prove itself able to carry the message faithfully and rapidly.

My experiments were carried out aboard the U. S. Navy's icebreaker "U. S. Edisto." My job was that of collecting the wildlife of the region for exhibit in the National Zoological Park in Washington. But I had this private project—the experiment with carrier pigeons; and when I boarded the expedition ship at Norfolk, Virginia, there were two pairs of carrier pigeons among my gear. They were confined in a small loft, 3 by 3 by 3 feet. The front contained the typical drop wire through which a bird could enter on its return from a flight. The loft was crude—I built it myself—but it was satisfactory. Before we sailed, a near-by feed store sent me 100 pounds of chicken scratch feed. This meager equipment was all I needed for my experiment.

I foresaw many difficulties but was hopeful for the final outcome. The polar weather did not worry me particularly, because the bird had already proved itself under arctic conditions in the last war. I was chiefly worried about other birds that might injure the carrier during its flight—particularly the skua.

The care that the birds required was a simple daily routine. It consisted of drinking-water and a handful of seed for each bird. If I could not attend to my birds for a day, the lack of food did not in the least affect their well being. Their hardiness and ability to adapt themselves to changing conditions fit them well for exploratory or military operations. During our entire trip, the birds maintained their health. They fed well, did not suffer from the various temperatures, and endured the 51-degree roll of the icebreaker without ill effect.

But I was afraid of the skua, the scavenger of the polar regions. I had seen the skua swoop down hawklike on the bodies of dead penguins and dig its hooked beak and long sharp claws into the flesh. When seals are slain for dog food on an expedition, it is the skua that frequents the carcasses. I could picture this big bird racing with my pigeons until the



carriers were weary and then, with a rasping caw, swooping down and putting them to death. It was the one great hazard with which my small loft of pigeons would have to contend.

The skua is the southernmost bird on the globe. It is abundant within the Antarctic Circle during the polar summer, and it was observed by Amundsen and Mawson inland over the Antarctic continent. It breeds upon all suitable shores of the continent and its islands. It winters chiefly at sea, probably in the ice pack.

The first flight ever made by a carrier pigeon within the Antarctic Circle took place on the morning of January 27, 1947. The flight was from the deck of the "Hashidate Maru," of the Japanese whaling fleet, to the home loft on my ship. I had obtained special permission to board this ship, where I was greeted by Major Waldon C. Winston,* American control officer of the whaling operation. He was surprised when, like a magician pulling a rabbit from a hat, I reached into my bulky cold-weather clothing and pulled out my carrier pigeon and released it.

Through my binoculars, I followed the flight of the bird as it circled and then headed for the home loft. It was a brief but successful flight. The ships were only about a mile apart.

Flight No. 2 was from Ross Island to my ship as she lay at anchor in McMurdo Sound. Ross Island is about 43 miles long from north to south and about 45 miles wide. Dominating the region of McMurdo Sound is Mount Erebus, 13,200 feet high. This is an active volcano, snow-covered and expansive. The active crater is about 12 miles in diameter and 900 feet deep, with vertical walls. Numerous eruptions were observed by the Shackleton Expedition in 1908.

It was my good fortune to be able to go ashore on Ross Island and collect penguins from the rookery that surrounded the former base used by Sir Ernest Shackleton. Upon landing from the gig, I reached into one of the spacious pockets of my field jacket and released a carrier hen.

The bird circled twice and then was immediately pursued by two skuas. Off the birds went over Mt. Erebus and out of my range of vision. I was afraid that this was the last I would ever see of my little carrier hen, because I didn't suppose she would be able to evade the skuas.

But when I got back to the ship in the late evening, there was the little hen, very much at home on her nest —her mate happy over her return.

Four other flights were made from Little America to the ship while she was tied to the ice in the Bay of Whales. The procedure was about the same in each case. I usually rode a "weasel" from the ship to the base and then liberated my birds. Always there was the thrilling chase by the skua, for the predatory gull was abundant in that vicinity. Always the pigeons succeeded in outmaneuvering the bird of prey.

It was an exciting sight to watch a pair of pigeons pursued by two or three skuas. First the birds would maneuver around like fighting planes jockeying for position. Then off they would go over the huge ice barrier and disappear. I believe that the pigeons deliberately led the skuas into a chase and enjoyed outsmarting their pursuers. Always there was that anxious doubt as to what might have happened to the birds. But always when I returned to ship, there they were.

The training of a homing pigeon begins when it is about three months old. It may be taken to the distance of about a mile from its loft and liberated in order that it may fly back. After a day or two, it should be carried three miles from home in the same direction and set free. For the third lesson, a few days later, the distance is usually increased to six miles.

During the season the training is continued, gradually increasing the distance until it is about 200 miles. Speeds of over 90 feet per second (about 60 miles an hour) have been recorded for various pigeons, but the average speed is rather less than half that amount.

The hardiness of the carrier pigeon and its power to endure and thrive under adverse conditions is amazing. It is swift of wing and enjoys flying and circling in flocks. Carriers can be seen on windy days going with the wind and at times enjoying the strong currents that toss them around.

The Signal Corps of the U. S. Army maintains a pigeon unit at Fort Monmouth, New Jersey. The Army birds have distinguished themselves in both World Wars. The courageous pigeon "Cher Ami" is a symbol of their daring, and the names of many other brave birds are written across the pages of history.*

My experiments now indicate that it is practical for a polar expedition to include carrier pigeons in their equipment for use as emergency messengers. Because of the hardiness of the birds, their care does not present a difficult task. Each bird would require about two cubic feet of loft space. The bird should be furnished with one handful of grain a day, plus drinking water. During subzero weather, it should be protected from winds; and ample material such as straw, excelsior, or other similar stuff should be kept on the floor of the loft to protect the feet.

Although the flights in my experiments were made during the antarctic summer, the ability of the pigeon to adapt itself to new environments leads me to believe that successful flights may be completed even under severe polar conditions.

In recent months our defense of the north polar regions appears to be paramount. With this in view I am developing from the nucleus of the birds that flew in the antarctic a "cold-weather strain" of carriers. They will be offered gratis to any serious polar expedition that may be interested. It is hoped that the armed forces will obtain a few of these birds and use them on their forthcoming maneuvers.

---

* Now Lt. Colonel, author of the article "The Largest Whale Ever Weighed," in the December, 1950, Natural History.

* See "America's First Air Mail," by Curtis Zahn; "Champion of Champions," by John K. Shawvan; "Feathered Battalion Again Takes Wing," by Rory O'Shane; "Miracle on Wings," by J. Rodger Darling; and "Pigeon ‡183/14 A.F.," by Sydney Moorhouse, in Natural History for Oct. 1943, Sept. 1941, Sept. 1941, Nov. 1940, and May 1940, respectively.

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thermometer hung from the center of the dome so that the mercury bulb is at shoulder level to men sitting on the bed platform. A foot higher up, it would be materially warmer.

If once raised above the freezing point, an oval snowhouse seven by nine feet, occupied by four men, should not drop again below freezing for a week, though the trap door be always open. After that, it may drop below freezing and continue to drop lower as the snow of walls and roof gradually becomes more compact and thus a poorer insulator.

VILHJALMUR STEFANSSON

New York, N. Y.

Birds and Lightning

SIRS:

In her interesting article on Audubon (January, 1951), Lucy Salamanca refers to a sudden storm described by Audubon. She terms it a "brief hurricane" and says that "sharp yellow streaks of lightning flashed across the water, striking a pair of whirling hawks . . ." Constance Rourke, in her biography *Audubon*, mentions this same storm. She notes that it lasted half an hour, and she seems more in tune with contemporary usage when she refrains from dubbing it a "hurricane." In her version, the birds are still whirling and still struck by lightning, but they have turned into a pair of nighthawks. I dare say that is just what they were, but I'm a little puzzled about the two of them being struck by lightning and plummeting into the sea.

Was Audubon perhaps being a little dramatic? The nighthawks I've seen in Florida are masters of whirling and plummeting and frequently *act* as if they had been struck by something even on the clearest of days.

Can you provide further information concerning birds and lightning?

Sarasota, Fla. WILLIAM B. KIP

The following information is offered by Dr. John T. Zimmer of the American Museum's Bird Department:

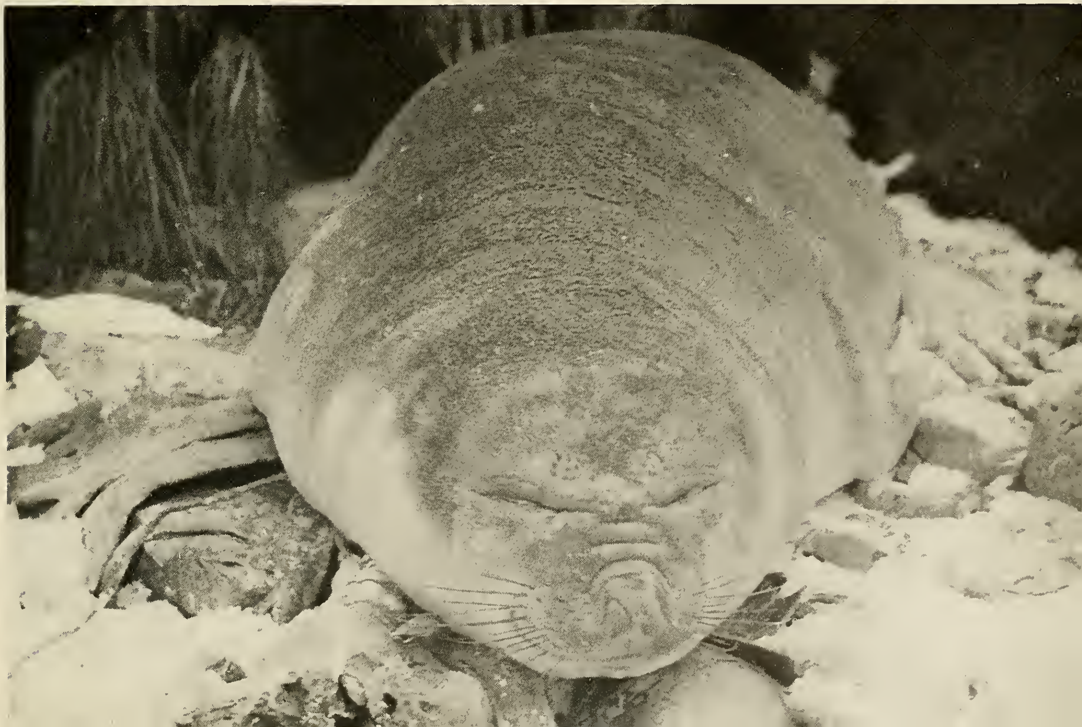
Audubon need not be accused of unduly dramatizing an observation when he reported having seen two nighthawks killed by lightning during a storm. They were nighthawks, incidentally, that he reported and not hawks of another sort. At any rate, his observation has the support of more recent observers, although reports are not numerous. Possibly this may be due to the limited number of individuals, both observed and observers, abroad during severe storms.

Some of the published accounts are speculative in that the birds were not actually seen to be struck or to fall. Some of the dead individuals later picked up may have been killed on the ground, although the evidence indicated that disaster overtook them in the air. One report leaves no doubt on that score. A large flock of lesser Snow Geese and Blue Geese was noted in flight when a sudden sharp flash of lightning was seen close by. A large number of the geese immediately fell toward the ground. Some of them recovered before reaching it and flew away, but more than 50 struck the ground. One of these promptly recovered and flew off, another was still alive but died shortly afterward, and the remainder were dead. Of these, one was badly mangled and several others were broken up inside, but none showed any sign of scorching. Audubon reported a similar lack of any indication of burning on his nighthawks, or any other signs of injury. On the other hand, some of the other published accounts mention strips denuded of feathers or partially torn or dismembered bodies of one or two of the individuals among those found dead, but still without signs of burning.

It is certain, therefore, that birds are sometimes killed by lightning while flying. Some may be killed by the direct electrical charge, some by aerial concussion, and some by striking the ground with sufficient force to rupture the internal organs. In the case of a large flock, as in the instance just mentioned, all three methods may come into play.

▼ A YOUNG SEA ELEPHANT, asleep in the snow on Marion Island, almost 1500 miles southeast of Cape Town. If you want to see how it reacted when the photographer clapped his hands, turn the page . . .

E. O. Hoppe photo



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short-lived in the tropics. Night rises from the lowest valleys almost on the heels of the afternoon which is retreating in the hills. It is a lonely, long race to reach the village or ship before blackness and mosquitoes mix in your path.

The last fuzzy twilight of dusk was fading rapidly when I reached the level road that ran through a coconut grove not far from the coast. My mental relief was great, and I could afford once more to dwell on thoughts of cannibals and being lost. Without warning, the figure of a large native loomed in front of me. A huge Fijian stood with feet set aggressively astride my way. He was holding a large war club. His huge crop of fuzzy hair and glittering white teeth were all that was needed to make that prickling sensation and heart thumping return. Was I walking on a sacred burial ground?

Then I saw that the great show of teeth was in performance of a friendly smile.

"*Mbula!* You like to buy war club?" he asked quietly in a clear English accent.

I burst out into a laugh of relief. "Very much so! Yes, how much?"

The usual answer to such an inquiry came: "One pound."

Four dollars! I was ready at that moment to pay twenty-four! I was penniless at the moment, so I finally traded my shirt and took the club.

The Fijian accompanied me to the main road, and as we were about to part, he pulled from the folds of his *sulu,* or sarong, a large cowrie shell.

"You buy big *mbuli-kula*?" he asked.

Mbuli-kula is the native word for the golden cowrie. I struck a match and held it close to the shell. It was a large flawless specimen with a rich orange hue. I blew out the match to conceal my excitement and began a fifteen minute bargaining bout of feigned indifference and declared poverty. I knew it was now or never, for yesterday's promised bargain in the South Seas is tomorrow's regret.

Hatless, shirtless, without knapsack and pants, I crept up the junk gangplank, a little late for supper; but with me I carried a war club and a golden cowrie. I also carried a firm resolution to start back early on all future treks into the hills.

The "Cheng-Ho" made several more stops in the Fiji Islands during the next few weeks, and from there went east to the Samoan Islands, where I continued shell collecting for another four months, on Tutuila Island. Most expedition accounts end in glowing tales of success, but I was able to obtain only one more golden cowrie, and under circumstances not unlike my Tunoloa experience. I am still in search of a living adult specimen and a set of its eggs, but I find that with each new tropical island explored, whether for the golden cowrie or the Glory-of-the-Seas cone shell, it is the searching and not the finding that brings the richest rewards.

. . . SUDDENLY ROUSED from its peaceful slumber, the rotound animal looked as alarmed as a man who has just remembered that his income tax is overdue

E. O. Hoppe photo

April

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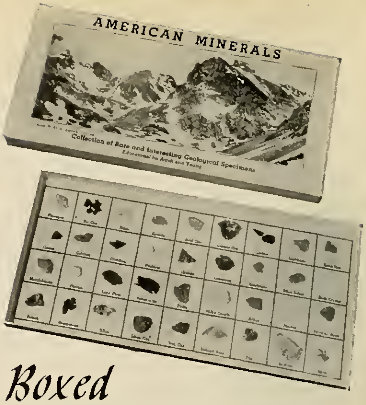
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Ewing Galloway photo

THE HIPPOPOTAMUS

(*hippos* = horse, + *potamos* = river)

In truth, the sage must feel remorse
Who named this beast the "riverhorse"

LETTERS

Beware the Collectors

SIRS:

Thanks so much for the February issue of NATURAL HISTORY. "Sky Islands of Arizona" by Weldon Heald is certainly well written. However, we are very much concerned about the collecting of both birds and mammals in these mountains, and especially in the Huachucas. The areas are small, and collectors come from all over. They all want to take hundreds of specimens. How long can this go on?

We would like to have some help in establishing an inviolate sanctuary there, where wildlife can be studied but not disturbed. Too many people are always eager to pile up a lot of dead skins, and

▲ An exceptional photograph of two praying mantises mating, by A. J. Arfsten

too few want to establish a safe haven for wildlife. Through efforts of the Tucson Audubon Society, and by order of the U. S. Forest Service and the Arizona Game and Fish Commission, Madera and Florida Canyons are now closed to collecting of all kinds. These canyons are in the Santa Rita Mountains. The Trogons, despite absolute protection, are just about gone from there. We were responsible for the egg collector being caught and fined in Madera Canyon in 1946.

We appreciate having William Carr to help with conservation measures; the pressure by hunters in this state is terrific. They are exerting every effort to have Saguaro National Monument opened to hunting right now, and they did succeed in opening Tucson Mountain Park to shooting last year.

Ross and Florence Thornburg
Tucson, Ariz.

Richard H. Pough of the Museum's Department of Conservation agrees that the extirpation of local races of birds seems a high price to pay to enable a few more museums to have a complete series of skins.

Singed Feathers and Cold Feet

Sirs:

We have been reading of the effect of thermal currents on birds' flight in Maurice Broun's *Hawks Aloft*. Do these currents also exist on a smaller scale in the case of small fires and hot objects?

The reason for asking this question is that we like to allow our canaries the freedom of the house and wonder what dangers exist for them. Would they be apt to land on the stove while the oven is on, or land on a hot pan over the direct flame, or on a hot iron? Are birds' feet very sensitive to warmth?

(Mrs.) Katharine C. Jones
Wausau, Wis.

The following remarks are offered by Dr. John T. Zimmer of the American Museum's Bird Department:

There is no doubt that thermal currents exist wherever there is heated air rising, but in the case of relatively small hot objects such as a hot pan or iron, it is doubtful that the current would be strong enough to have a very disturbing effect on a bird flying near or through it. The bird probably would be aware of the current but would be quite able to cope with it.

The question of possible injury to birds alighting on the hot object is more immediate. Nevertheless, there appears to be good evidence that a bird can perch or stand on quite hot objects for an appreciable time without harm, although the literature on the subject is very limited. The only report I have seen that is at all illuminating was published by L. T. S. Norris-Elye in *The Auk* (vol. 62, p. 455, 1945). He reported Canada Jays perching on the rim of an iron pot that was standing on an almost red-hot stove and remaining for 30 to 40 seconds before leaving. Several times they stood on the stove itself for five to eight seconds, showing a little nervousness but no actual discomfort.

NOTICE—Readers are encouraged to submit their own photographs of natural history subjects. Those selected for publication on these pages will be paid for at $3.00 each, with full credit to the photographer. Return postage must be included.

At the other end of the scale, it is common observation to see ducks paddling actively about in icy water. It seems quite certain that birds' feet must be almost impervious to considerable thermal severities. The feet are composed largely of tendons and bones covered with scaly integument (sometimes reinforced with feathers for added protection but usually not), and there is little moisture present to freeze or be affected by heat. It is possible, even, that the blood circulation may be withdrawn from these extremities during times of the greatest severity. At any rate, it has been calculated that if a bird in subzero weather were obliged to keep its exposed feet at the regular temperature of its body, it could not eat enough food to overcome the heat loss and survive. Some mechanism must exist to allow the extremities to approximate the outside temperature without affecting the body as a whole. If this is true, extreme heat, short of actual burning, could be tolerated for a time—at least until it reached, by conduction, a more vulnerable place.

There appears to be little danger, therefore, to canaries that might encounter some hot object in the room, except an open flame that might suddenly singe their feathers and cause them to drop into it.

Protection against Porcupines

Sirs:

I would like to make inquiry regarding porcupines. A lady living in Ohio, who with her husband has a hunting lodge in Pennsylvania, tells us that they are very much troubled with porcupines eating the framework of the lodge. She wonders if anything can be done to deter the animals or keep them away. Do your mammalogists have any solution?

Roy C. Thomas,
Associate Pathologist

Ohio Agricultural Experiment Station,
Wooster, O.

The following information is offered

Continued on page 190

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VOLUME LX—NO. 4
APRIL, 1951

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From a color photograph by Walter Henricks Hodge

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You will find Natural History *Magazine indexed in* Reader's Guide to Periodical Literature *in your library*

THE COVER THIS MONTH

The full-color photograph on this month's cover, taken by Walter Henricks Hodge, has more than artistic interest. In the similarity of pattern on the flower and the butterfly, one wonders whether there might be an example of parallelism in the plant and animal kingdoms. The flower is one of the wood lilies, *Lilium philadelphicum*. The butterfly is one of its common pollination agents, a meadow fritillary of the genus *Argynnis*. This butterfly visits many flowers of the woodlands.

The cutaway base of this flower is common to all vertical standing lilies, and it has been suggested that this has survival value for the plant. During heavy summer showers, the rain passes to the ground without washing out the nectar upon which the flower is dependent as a lure for the insects that pollinate it. Lilies with a closed cup catch no rain either, for they always grow "mouth down."

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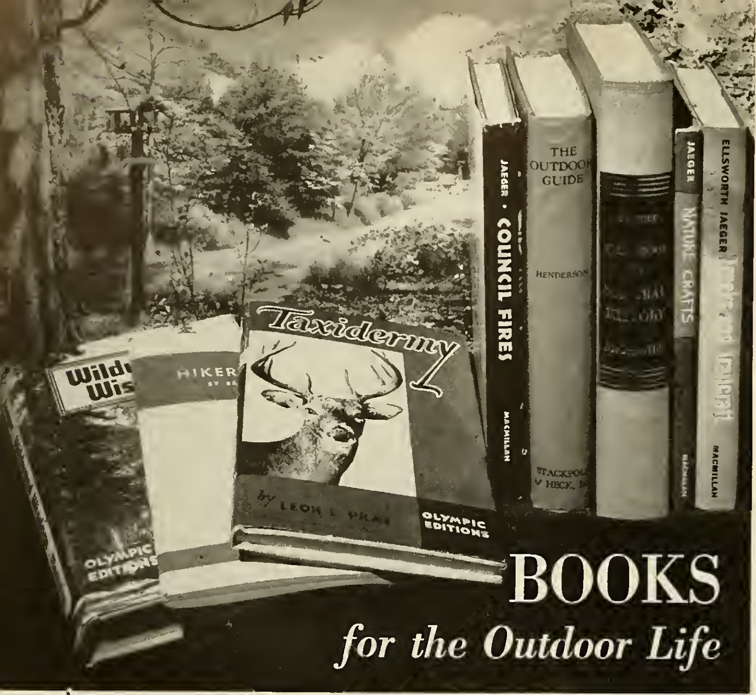

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THERE'S ALWAYS ADVENTURE

--- by Grace E. Barstow Murphy

Harper and Bros., $4.00
299 pp., 45 illusts.

THE author begins with the avowed intention of blowing the "wifely horn" for those wives who have lived unsung in "the shadow of the Lion." She meets modern woman's dilemma head on, frequently with outspoken resentment but never with malice. It makes a warm and lively book.

Mrs. Murphy did not travel for escape. Often she had three children with her. But whether with family or friends or alone, she always took along herself, her eager mind, sympathetic heart, and questioning spirit. There is a bouyant determination to get the most out of each experience—whether a dizzy ride over the Andes, an albatross in flight, a native dish, an unfriendly sea lion, or a desert night. There is a simple gratitude that takes nothing for granted, whether lilacs at her Bronxville window or the courtesy of her Ecuadorean hostess. There is a gleeful gratitude for the chance to show that she can take it as well as the explorers when the gales strike, the mud deepens, or the water runs out.

Her style, unorthodox with its feminine disdain for intervening steps, suits the breathless tempo. The description of the penguins in the Snares Islands is enchanting.

The bulk of the book is travel and natural history, but she never strays from the problem of being both a person and a wife, with its frustrations and compensations. It is a startlingly frank exploration into marriage. And where insight fails there is saving humor and quick sympathy that few can match.

You may say that despite her frankness, her emotional spontaneity, her earnest effort to understand intellectually, she doesn't always come up with the final answer. But who wants to read a book that gives all the answers? Each reader will find himself hunting for his own. That is the fun. And that is the reason *There's Always Adventure.*

SUSANN WEYER

WILDLIFE MANAGEMENT

---------- by Ira N. Gabrielson

The Macmillan Co., $4.50
274 pp., 40 illusts.

DR. GABRIELSON captions his last chapter with the question: "Can Public Hunting and Fishing Be Maintained?" His answer is a qualified "yes," and his reasons for so qualifying his answer become apparent as one reads this interesting book.

Wildlife Management deals in a popular, nontechnical manner with the conservation, use, and management of those forms of wildlife that we classify as game. No man in America writes with greater authority on the subject than Dr. Gabrielson, who now heads the Wildlife Management Institute after a long career with the U. S. Fish and Wildlife Service.

The picture he paints is not a pleasant one. True, we no longer slaughter game for the markets, but even that slaughter left more of many species than we have today after a century of drainage, dam building, overgrazing, and soil erosion. Within the past decade modern high-speed mowing machines, more potent insecticides, and clean fence rows have further accelerated the decline of farm game even on our good lands. Yet, despite this decline, 20 to 30 million Americans go forth each year with rod and gun expecting to bring home at least a few trophies of the chase.

Although we are admittedly faced with a crisis with respect to many species, Dr. Gabrielson paints from firsthand knowledge a picture of waste, inefficiency, and lawlessness that is a serious indictment of our honesty and common sense. Half of our states still virtually throw away their game funds on politically appointed staffs that accomplish little except to cater to the foolish whims of barber-shop experts. Too many conservation department directors still try to "give the sportsmen what they want" instead of honestly letting them know what they can reasonably expect to get. Too many legislatures still try to set every detail of the hunting seasons and bag limits on a basis of political expediency instead of leaving the matter to experts who have some idea of how much game is going to be available. That much could be done is apparent from the examples cited in this book. However, it will never be done until the conservation job is assigned to trained professional men whose expert advice we accept as we do that of the family lawyer or doctor.

RICHARD H. POUGH

THE LAND OF THE CAMEL

TENTS AND TEMPLES OF INNER MONGOLIA

- - - - - by Schuyler Cammann

The Ronald Press Co., $5.00
200 pp., 39 illusts.

STRANGELY enough, as a member of a United States Navy team, Dr. Cammann was sent on a mission into the Ordos Desert of Inner Mongolia during 1945. His duties were not arduous, and particularly after the Japanese defeat, when he was unable for a number of weeks to return to Chungking, he had

"A remarkable book .. It spans the earth."
—WILLIAM BEEBE

THERE'S ALWAYS ADVENTURE

The Story of a Naturalist's Wife

by GRACE E. BARSTOW MURPHY

"An ever-moving mixture of intimate biography, wide travel, absorbing natural history and personal adventure garnished with some poetry and much good humor . . . truly a revealing book—the 'home work' behind the field work of a great naturalist. It gets better and better as it goes along and the last chapter alone is worth the price of admission." —JOHN KIERAN

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time to travel about and get to know the Mongols and Chinese of the region and also to explore a number of the Mongol Lamaist temples. Able to speak Chinese and being an expert on Far Eastern art—now in the Chinese Department of the University Museum, University of Pennsylvania—he made very good use of his time.

The book at hand is a narrative of these experiences. It is not a tale of high adventure, although Dr. Cammann and his friends had their share of curious encounters with the Mongols and Chinese, of trucks broken down in the desert, and the riding of camels in lieu of those trucks. More important are his observations of the people and their customs and the predicament of the Mongols, whose traditional way of life is being snuffed out by the encroaching Chinese. And still more in line with the author's particular interest are the accounts of his many visits to the Mongol Lamaseries, temples of the Tibetan-Buddhist faith, which retain many elements of the ancient Asiatic religions.

This is a pleasant and very readable book. In the running account of his travels Dr. Cammann manages painlessly to impart a formidable amount of information on an interesting area and one that is of particular importance in world affairs at the present time. Only on looking back at the book is one aware that he has come to know rather well a strange segment of the world's people. I recommend it highly.

Gordon F. Ekholm

ELEPHANT BILL

- - - - - by Lt. Col. J. H. Williams

Doubleday and Co., $3.00
250 pp., 42 illusts.

COLONEL WILLIAMS has written an interesting and authoritative account of training elephants for work in the teak forests of Burma and of using these intelligent beasts during the critical days of the Japanese invasion.

The author might be called an elephant career man. He has devoted many years of his life to acquiring a knowledge of their ways, and he is in as close harmony with them as it is possible for a man to be. The reader of this book will conclude with feelings of admiration for both the elephants and "Elephant Bill."

The story is simply written, and because there is no conscious striving for effect, the impression is one of sincerity. There is plenty of drama, nevertheless, for elephants are powerful and get out of control at times. War brought to Burma situations that challenged the utmost in the animals and the men who handled them. The reader is given many firsthand incidents of how this challenge was met.

Colonel Williams is a good observer and has an understanding and sympathetic affection for elephants and for the natives who are so closely associated with them. Since the elephant's span of life is about that of man, frequently an elephant and its master spend an entire lifetime together.

So far this mechanized age has not developed a machine that can equal the elephant for efficiency over much of the territory where teak is grown and harvested. Under the pressure of war it was proved that elephant transport could do things beyond the capacity of wheels and wings. Where nature was raw the elephant was in his own.

The book has a number of half tones which illustrate much of the underlying pattern of elephant behavior. They also give some insight into the environment and show the fine type of native who works with elephants in Burma.

Harold E. Anthony

SCIENCE AND COMMON SENSE

- - - - - - - - - by James B. Conant

Yale University Press, $4.00
371 pp., 32 figs.

THIS volume is phrased for the layman, and the selection of subject matter includes concepts that have revolutionized scientific thought and directed the destiny of man.

Much space is given to defining the criteria that distinguish science from other disciplines of thought. "Science is an interconnected series of concepts and conceptual schemes that have developed as a result of experimentation and observation and are fruitful of further experimentation and observations."

A scientist should be skeptical. People develop habits of thought and take for granted fundamental assumptions that will not meet the test of sufficiently critical analysis. The author shows how the thinking of centuries has been conditioned upon acceptance of concepts that seem absurd to us today. Some of the current scientific philosophy may seem as queer to the people living one hundred years from now. Doubt as to the validity of concept should have a reasonable basis; in brief, it must be a challenge to common sense.

An element of timing enters into the progress of scientific thought. A concept may appear before man is ready for it, and years may pass before the idea receives the acceptance it merits. In other instances, man has seemed to be awaiting the idea and eager to put it to use.

Concepts may be the end result of long experimentation; they may arise as "hunches" with rather sparse antecedent rationalizing. Science may be pure; it may be applied; it may follow a line that has a certain termination; it may lie in fields with infinite possibilities.

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The examples of great forward strides in science are often familiar demonstrations in the physics laboratories of high schools and colleges. Higher mathematics is not involved, and the concepts are those of a finite universe. The pattern of success in scientific thinking seems to be as clearly demonstrated by these simpler illustrations as by the mysteries of nuclear fission or variable yardsticks.

This is not a book to gulp at a sitting. It well repays the deliberate reading it requires.

HAROLD E. ANTHONY

CULTURE IN CRISIS:

A STUDY OF THE HOPI INDIANS

- - - - - - - - - by Laura Thompson

Harper and Brothers, $4.00
221 pp., 45 illusts.

TO those who are accustomed to regard anthropology as an esoteric science, unconcerned with practical affairs, Dr. Thompson's study of the Hopi Indians should prove a rewarding experience. In essence the book is a clinical diagnosis of the cultural crisis at present confronting the Hopi and a concise analysis of the major contributing factors. The author also makes sensible suggestions as to ways in which the crisis might be resolved effectively and offers sound advice to Hopi administrators. The implications of this book are not, however, confined merely to the 4000-odd Indian inhabitants of the Hopi reservation in northeastern Arizona. As John Collier points out in his introduction, the approach to the Hopi problem has forged an instrument of study applicable in far broader situations of trusteeship administration.

The present study is the result of one of a series of tribal investigations conducted under the joint auspices of the United States Office of Indian Affairs and the University of Chicago, and the ultimate goal of this project was to implement the effectiveness of the Indian Service program. Over 50 scientists from many disciplines participated in the Hopi project alone, as well as representatives of the Indians themselves. This battery of researchers assembled evidence which discloses that the Hopi suffer from insufficient land, overgrazing, overpopulation, poor health, and inadequate diet as well as destructive ideological pressures from without. Investigation also revealed that these problems may not be resolved without constantly taking into account Hopi personality and culture.

Although Dr. Thompson's interpretation of Hopi society differs in some very important respects from that of other specialists, we cannot afford to ignore her central thesis: namely, that if the world's people are ever to live together in harmony, the principle of cultural autonomy must be recognized, accepted, and respected.

HARRY TSCHOPIK, JR.

OUR DESERT NEIGHBORS

- - - - - - - - by Edmund C. Jaeger

Stanford University Press, $5.00
239 pp., 13 plates, 33 photos, 20 drawings

A CASUAL visitor hurrying across the deserts of southwestern United States by auto or train would consider the country almost devoid of animal life. An occasional bird, jack rabbit, antelope ground squirrel, or, if one is fortunate, a coyote may be seen making a hasty retreat. But if one is interested and takes time to investigate, he will find that there are innumerable tracks showing that the desert supports a large number of interesting creatures, whose acquaintance is well worth the effort. One reason for the seeming scarcity of life is that most of the animals are nocturnal.

Edmund C. Jaeger has explored these deserts for more than 40 years and has lived in close intimacy with the wildlife found there. He is a man capable of writing in a most informative and interesting manner, and one is fortunate to be introduced to these creatures through his observations.

There are 37 chapters in this book, each dealing with a specific form or a closely related group. One chapter of outstanding interest tells of the hibernating habit of the poorwill, the western representative of our eastern whippoorwill. Many years ago the general belief was that birds hibernated; swallows and swifts were thought to bury themselves in the mud and other birds to retire into hollow trees for the winter. Later, when the winter ranges of these birds were discovered, the idea that birds hibernated was discredited. Now, however, Mr. Jaeger has proved that some birds do occasionally hibernate.

Good photographs illustrate the book, and drawings head many of the chapters. I enjoyed reading the text and feel sure that my next visit to these deserts will be of much greater interest through the knowledge that I have obtained from the pages of this book.

T. DONALD CARTER

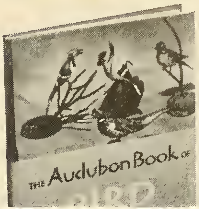
SEQUOIA NATIONAL PARK:

A GEOLOGICAL ALBUM

- - - - - by François E. Matthes

Univ. of California Press, $3.75
136 pp., 125 illusts.

THIS volume is, in a sense, a companion to Dr. Matthes' recent *The Incomparable Valley*, a popular account of the geology of the Yosemite National Park. It differs, however, and is unique among geologic volumes in the method of the treatment of its subject. Formal text is kept to a minimum, the story being told by means of 112 photographs and 13 diagrams, all with somewhat extended titles. The photographs show exceptionally well the geologic features being considered. Unfortunately, their reproduction suffers somewhat from the paper used; a glossy paper would have afforded better rendition of some of the finer detail.



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The history behind the volume emphasizes its authenticity as well as the value of this method of exposition. Completing his studies in the Yosemite Park, Dr. Matthes turned to the Sequoia area, planning to prepare a geological report on the region. This work was interrupted by the requirements of other geologic problems assigned him. The National Park Service, however, was anxious to have available for use by its ranger-naturalists the geologic information that Dr. Matthes had obtained. At their request he prepared three albums of carefully selected photographs, with a short descriptive text to accompany them explaining the geologic history of the Park. These proved of unusual value both to the ranger-naturalists and to the visitors in the area.

When Dr. Matthes died in June, 1948, without having been able to complete his report on the geology of the Park, it was decided to make his Sequoia albums available to the public. The result is the present volume, issued under the editorship of Dr. Fryxell.

Because the story is concerned with the effects of the geologic processes in the formation of mountain landscape, the il-

Continued on page 192

The

Clues hinting that this Bermudian petrel might not have been exterminated led to an expedition to locate its nesting place

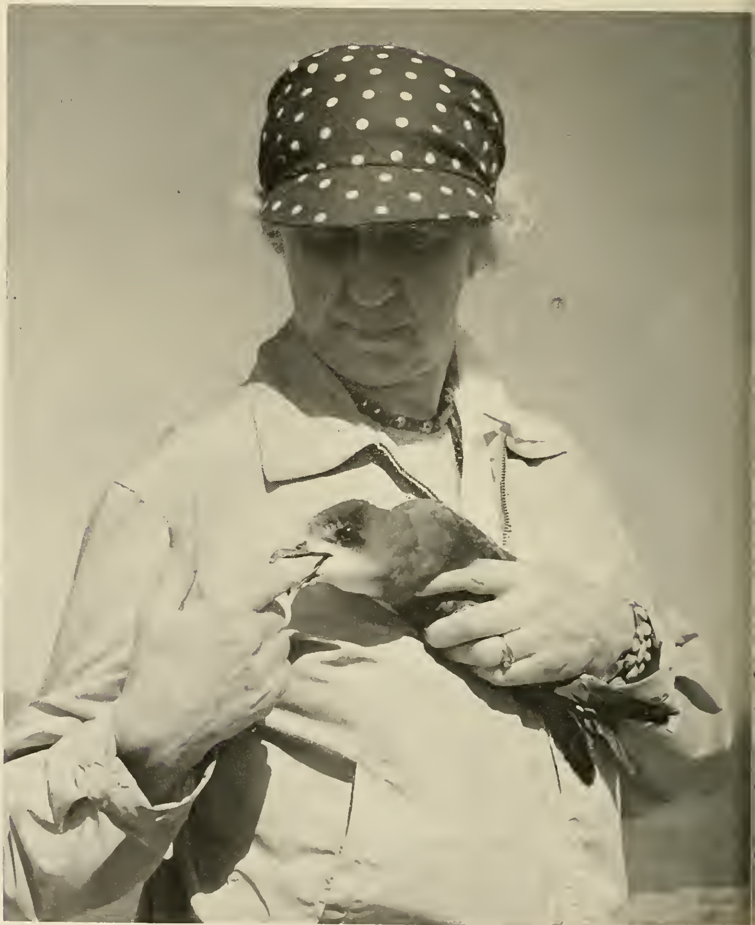
IF we might see Bermuda as it was during the millennia between the end of the Ice Age and the discovery of America, we should doubtless have a glimpse of the primitive world such as only poets and naturalists have envisioned. For Bermuda was one of the few untilled gardens without human beings. When man first arrived at "the still-vex'd Bermoothes," as Shakespeare calls them in the *Tempest*, the cahow dwelt in myriads over the greater part of the Archipelago. It burrowed wherever soil existed and entered the numerous limestone caves and grottoes that date from early postglacial or interglacial time.

In 1619, Governor Nathaniel Butler, of Bermuda, wrote:

"For the cahowe (for so soundes his voice), it is a night bird, and all the daye long lies hidd in holes of the rocks, whence both themselves and their young are in great numbers extracted with ease, and prove (especially the young) so pleaseinge in a dish, as ashamed I am to tell how many dosen of them have been devoured by some of our northern stomacks, even at one only meale."

A still earlier record, unearthed by Dr. William Beebe, comes from a Spaniard before the landing of the English. Don Diego Ramírez reported:

"The first night that I anchored in the bay, I sent a small boat to an inlet to look for water, but none was found. At dusk, such a shrieking and din filled the air that fear seized us. Only one variety of bird makes this noise, but the concerted yell is terrible, and standing out from it were individual voices shouting diselo! diselo! (tell 'em, tell 'em). One seaman said to me: 'What is this devil trying to tell me? Out with it! Let's hear what it is!' I replied: 'A la! These are the devils reported to be about Bermuda. The sign of the cross at them! We are Christians!' While we were in this confusion, the men of the small boat rushed up, exclaiming in their alarm, 'What devils are these? The boat's rudder is broken.' I ordered another to be made immediately, because in the morning the coast had to be searched for water. One Venturilla, a Negro, was sent on shore with lantern and axe to cut a piece of cedar. The moment he landed and entered the bush, he set up such a yell, that I shouted: 'The devil's carrying off the Negro! Everybody ashore!' The men jumped into a boat and rushed to the spot, where the Negro was brandishing his lantern and his fists against the birds, and mingling his yells with theirs. The birds, meanwhile, attracted by the light, dashed against him, so that he could not

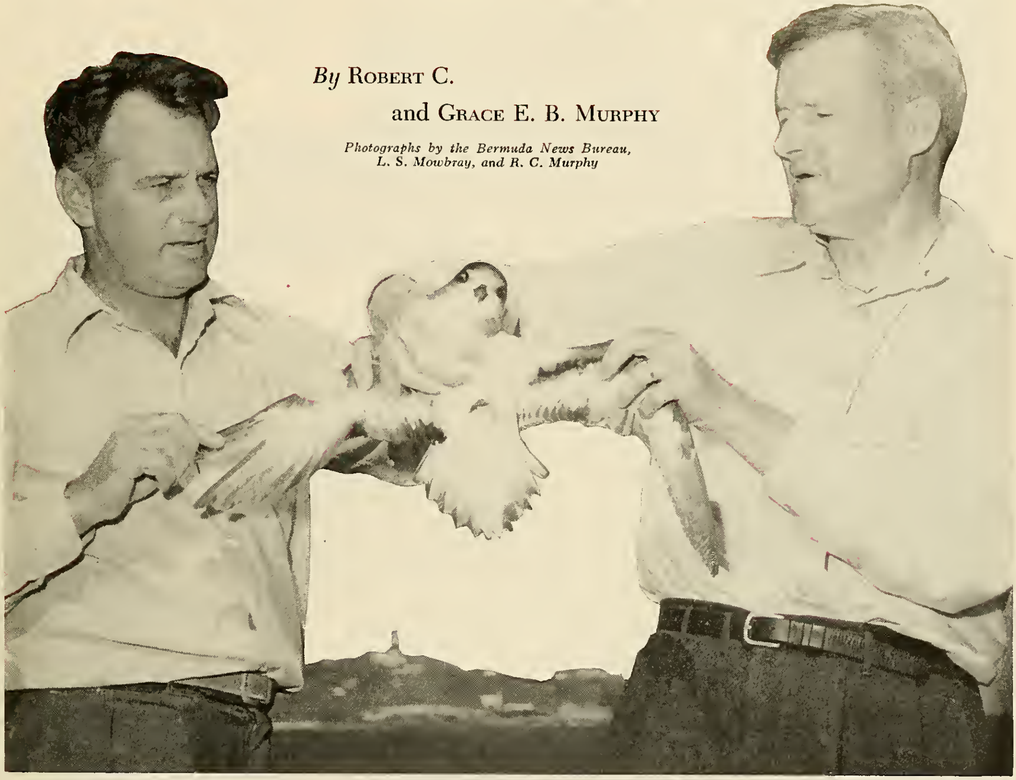


➤ **Grace E. B. Murphy** with a cahow just lifted from its egg. Though it could have drawn blood with its beak, this cahow, like the others handled, proved more playful than pugnacious

CAHOW Still Lives

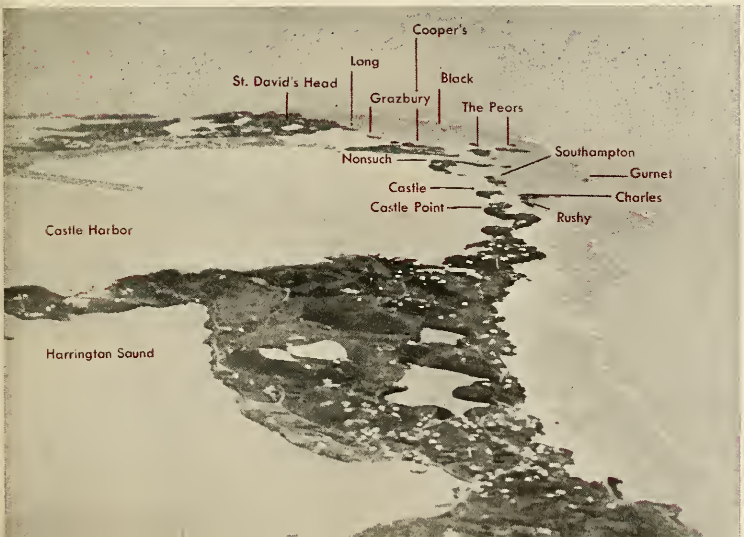
By ROBERT C.
and GRACE E. B. MURPHY

Photographs by the Bermuda News Bureau,
L. S. Mowbray, and R. C. Murphy



▼ EASTERN BERMUDA, showing all the islands of Castle Roads. Along the right or southern coast stretches the foam line of the reef

▲ A CAHOW hauled out of its burrow by pole and noose on an islet a short distance off St. David's Island. Louis Mowbray and Robert Cushman Murphy are about to mark it with a U. S. Fish and Wildlife Service band before releasing it



Cooper's
Long
Black
St. David's Head
Grazbury
The Pears
Nonsuch
Southampton
Gurnet
Castle
Charles
Castle Point
Rushy
Castle Harbor
Harrington Sound

keep clear of them even with a club. Neither could the men of the relief party. More than 500 birds were brought off to the ship that night, and having gone through hot water and been plucked, proved to be very fat and fine. Thereafter a capture was made every evening. The birds were so plentiful that 4000 could be taken in a single bag. The men relished them enough to eat them all the time, and when we left we brought away more than 1000 well dried and salted for the voyage."

Bermuda, like New Zealand, was a land without mammals. The first dangerous interlopers were the crea-

▲ **Surmounting Islet "A"** to the limestone layers under which at least six pairs of cahows were nesting

➤ **Louis Mowbray** discovers with his flashlight a mated pair of cahows in a straight burrow eleven feet long. At anchor is the seaworthy Aquarium launch that carried the party to practically all islets of the Castle Roads area

▼ **This proved** to be one of the few nesting chambers that was accessible. Having opened it with a prospector's pick, Dr. Murphy and Mr. Mowbray are examining the green twigs of which the nest was formed. The egg found in this burrow hatched later

tures that man left behind after his encampments. They were brought by the Spanish discoverers, under Juan Bermudez himself, in the early sixteenth century, or by the buccaneers who followed. These curses were first, pigs, and second, rats. As regards pigs, the motive was to leave a supply of meat for mariners. But the effect upon the defenseless flora and fauna of Bermuda was drastic. It would be hard to conceive any plague more devastating than herds of rooting wild swine. Ground-nesting birds and fruit-bearing plants alike melted away before their onslaught, and we may take it for granted that the cahows had been eaten out of existence over the greater part of Bermuda before the first British settlement in 1609.

The rats, presumably accidental immigrants, were the more or less tropical roof rats that haunted ships. What the pigs had left, the rats finished. Descriptions of the tidal waves of rats in the language of 1610 are quaint but horrible. After making the growth of crops impossible, the rat armies are said to have poured into the sea like overpopulated lemmings.

At the date of British occupation, the cahow still held out in fabulous numbers at the group of islands off Castle Harbor, not far from the first settlement at Ft. George's. To most of these, no doubt, the hogs had not swum. A special center of abundance was Cooper's Island, southwest of the eastern end of Bermuda. The unusual circumstance of a sea bird breeding in the winter of the Northern Hemisphere meant that food could be obtained when other birds were not available. Not long after the famine-haunted season of 1614-1615, the birds were said to have been completely extirpated. The cahow became a legend.

For 300 years its identity and its affinities were not certainly known. It was confused with at least two other species of petrels and even with the members of a quite distinct family, the auks. Not until 1916, when bones from ancient caverns were studied and compared, did the idea gain credence that the cahow was a petrel of the genus *Pterodroma.*

Nobody saw a living cahow again until the year 1906, and then the finder did not know that he had rediscovered it. On February 22 of that year, Mr. Louis L. Mowbray, a Bermuda naturalist who was Curator of the Government Aquarium, managed to land upon the isolated stack called Gurnet Rock, off Castle Roads. He took from a chink a living sea bird, which was first referred to in print by the name of a New Zealand petrel! The specimen was fortunately preserved, but not for another decade was it correctly associated with skeletons of the historic petrel and scientifically described and named, by Mr. Mowbray and Mr. John T. Nichols, as *Pterodrama cahow.* This bird, now in the American Museum collection, is the type specimen of the species. In June, 1935, a fledgling petrel of the same sort struck St. David's light, close to the old nesting ground on Cooper's Island. It came into the possession of William Beebe, then at his laboratory in Bermuda, and he published a spirited account of the rediscovery.

Ten years later, during World War II, an American Army officer, Fred T. Hall, now Director of the Public Museum at Davenport, Iowa, was stationed at Bermuda. Hunting for signs of cahows, he found fragments of birds that had apparently been killed by rats, and even a partly disintegrated adult that had floated ashore.

Here was a fascinating and slightly hopeful chain of events. Petrels ordinarily come and go only at night, feeding chiefly many miles out at sea. They live underground on unoccupied islands. At least a few cahows had evidently survived for three centuries without Bermudians or naturalists elsewhere knowing anything about them. It was hardly likely that the species was any more "extinct" in the year 1951 than it had been in the year 1906. Such was the train of thought. When we divulged it to Mr. Childs Frick, a Trustee of the American Museum, who owns a home in Bermuda, his response was: "That is the most exciting idea I ever heard in my life." He generously contributed to the budget of the Department of Birds a sum that would make possible a field investigation. Mr. Marshall McLean, Treasurer of the Pan American Section of the International Committee for the Preservation of Bird Life, made an additional gift in the name of his organization. So getting into touch with Louis S. Mowbray, present Curator of the Bermuda Aquarium and son of the original rediscoverer, we flew to Bermuda on January 23, 1951.

For a week we lived at the home of Mr. and Mrs. Frick on Castle

▼ SEARCHING for other burrows on the same islet: a view showing the extreme erosion and disintegration of the small limestone islets that are the las

stronghold of the cahows

Point and for another ten days at the Bermuda Biological Station for Research, in St. George's West. In company with Mr. Mowbray, who supplied a diesel launch and a peerless knowledge of local waters, and with a young Bermudian ornithologist, David S. Wingate, we made a thorough investigation of islets off Castle Roads when weather permitted. Landing at Gurnet Rock was impossible in the boisterous winter seas encountered. We soon learned that the likelihood of finding traces of cahows was in inverse ratio to the prevalence of rats. Castle Island, for example, is large, accessible, and frequently visited because of its fascinating, well-preserved, seventeenth-century fortifications. Brown rats abound and can be seen even in bright sunlight, and the island has no burrowing or ground-nesting birds. Cooper's Island is now out of the running, for it has been linked up through dredging and filling with St. David's Island and forms part of the Bermuda Air Base.

The first real indication of cahows in residence was found on January 28 at an islet which, for the safety of the birds, we shall call just "A." Like many others in the neighborhood, it is greatly eroded, broken into several nearly distinct parts, and overgrown on the crown with grass, prickly pear, sea lavender, and a few other spray-resistant plants. We scrambled ashore in the forenoon. In several places at levels 20 to 30 feet above the water there were holes in interbedded reddish soil, under or between limestone strata. Fresh earth at the entrances revealed neither scratches nor footprints, but there were soft patches of green and whitish excreta such as are characteristic of squid-eating sea birds. It seemed discouraging at the time that we could detect no trace whatsoever of the familiar musky odor that is ordinarily a telltale of petrels within.

Most of the tunnels were both deep and crooked. Presently we located one in which an electric flashlight revealed a bird in the nest chamber. The entrance was at the rear of a rocky niche large enough to accommodate a man's head and shoulders. Four feet within, a horizontal excavation seven to eight inches in width and somewhat less in height had been bored in a straight line to a depth of just over six feet. With a noose at the end of a bamboo we succeeded in hauling out the bird. There was a breathless moment before daylight showed it to be the longed-for but only half-anticipated cahow! Its egg could then be seen in the nest.

Our almost unbelievable captive bit the hands that grasped it but only half-heartedly. Within a moment it became completely unresistant, allowing itself to be stroked, tickled, and passed from hand to hand. We banded and photographed it and jotted down hasty descriptions of its flesh colors, including the pink feet. When put on the ground, it scurried back to its egg. During the whole period of badgering, extraction, and handling, it had neither uttered a sound nor ejected oil from the throat or nostrils. The last point is noteworthy. No cahow handled during our visit spewed out stomach oil in the reaction that is so common among petrels. All the birds remained docile, dry, and fluffy, as well as practically devoid of odor.

Our little islet, like Cooper's Island itself, had evidently fallen within the wartime target area. Its top was peppered with green, corroded, and distorted bullets of small arms. So far as could be judged, this had had no deterrent effect upon the return of the cahows. Even more remarkable, perhaps, the petrels still come back seasonally to their ancestral homes despite the glare of beacons on the near-by airfield and the close roar of planes.

Our next step was to stand watch on islet "A" through the night of January 29. The swell was high in Castle Roads, and the ocean still rougher off Gurnet Rock and outside the boiling skerries, but we found quieter waters when we passed through a gap in the reef just east of Cooper's Island. We landed from our skiff on a convenient ledge, and the launch was sent back to the Aquarium.

With the aid of a seven-foot ladder, we transported our gear over a miniature precipice to the top of the islet. For the early evening all hands stationed themselves beside the gully leading to the first cahow's nest. Later we spread out over the islet so as to keep as many nests as possible under observation. At 52 minutes after sunset, the luminous worms known as *Odontosyllis* came to the surface below our perch and made a grand star-blue display in the water. Sirius was shining at the time, and the lights of the worms were considerably bluer than that star. Louis reported that the essential degree of darkness for the creatures usually comes at precisely 52 minutes after the sun has gone down and that the sparkling continues for about 20 minutes.

After dark, the revolving signals of Kindley Field periodically touched the summit of our islet with faint gleams. As soon as the sky had lost all trace of afterglow, we began to see swift silhouettes of birds overhead and from time to time to hear single, soft *screepy* notes. At 8:32 P.M., a cahow fluttered above our huddled forms on the ledge, passing several times back and forth in front of the niche. Then it dropped silently into the entrance. Three torches were turned upon it, and the bird was picked up. We all examined it, then put it down. It walked unhurriedly into the burrow, carrying its wings slightly spread and drooped.

Shortly after nine o'clock, a group of cahows flitted about, glimpsed in a twinkling against the dark sky. Our watchers had by this time dispersed to their several stations. Each member saw birds, and David, the youngest, heard the single, soft note more often than the rest of us. It was impracticable to estimate the number of cahows in flight because they all scouted to and fro briefly before coming down.

We two clung to our uncomfortable ridge and continued to watch. The clouds presently began to close in from the southwest. Orion and the Great Bear first became hazy and filtered-looking and then were blotted out. The water swirled and

Continued on page 189

CHIAPAS—A Naturalist's Paradise

Explore the matted jungles of southernmost Mexico—an exotic wonderland where size is king and variety challenges the imagination

By ARTHUR STANLEY RIGGS

A VAST wonderland for the naturalist lies to the south of us where once the Mayas roamed. Of good roads there is not one in all that tremendous expanse of jungle and mountain ranges. The brawling, dangerous rivers and a few matted, almost invisible old trails are the only communications. Travel is difficult at best, and he who goes exploring there must be tough and willing to live largely off the country.

This region is the State of Chiapas in southern Mexico, bordering the Republic of Guatemala on the east and touching the Pacific Ocean on the south. Its rich soil, humid heat, and network of swift rivers have developed a plant and animal life of astonishing variety. So prolific is nature that the Indians, when they want a few vanilla beans, do not bother to save the vine but cut it down, along with the small tree around which it twines, and pick the huge pods without having to stretch or climb. And the mahogany we consider so valuable is used here for posts and palings or to stoke the kitchen range in ranch houses.

Two main objects sent me to Chiapas: a deep interest in Mayan culture and its remains, and—for the moment more pressing—the

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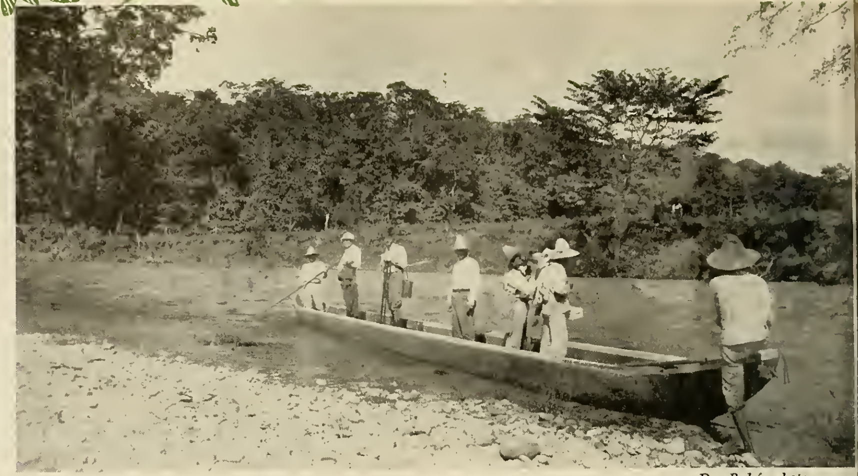
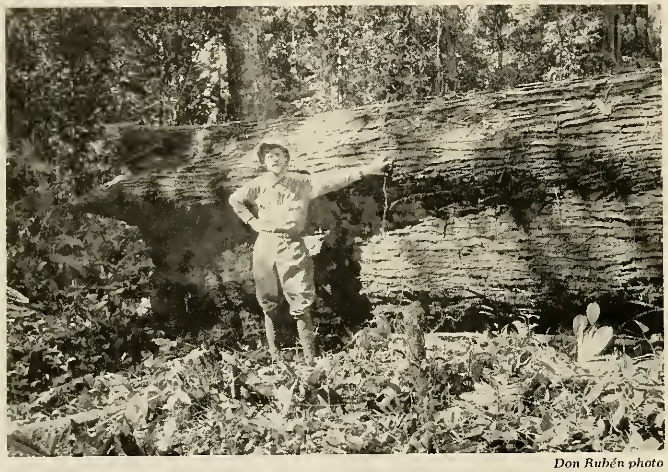
➤ ONE TYPE OF TROPICAL BOAT: lumbermen poling up the Usumazinta River in Chiapas

➤ A large canoe used by the author in exploring parts of Chiapas—a boat 49 feet long and 41 inches wide. It had a 12-inch runway topping the gunwale for the Indian polers



Don Rubén photo

▼ The author beside a mahogany cut for his benefit —a tree described as relatively small. It measured 7 feet in diameter at the butt and 92 feet high



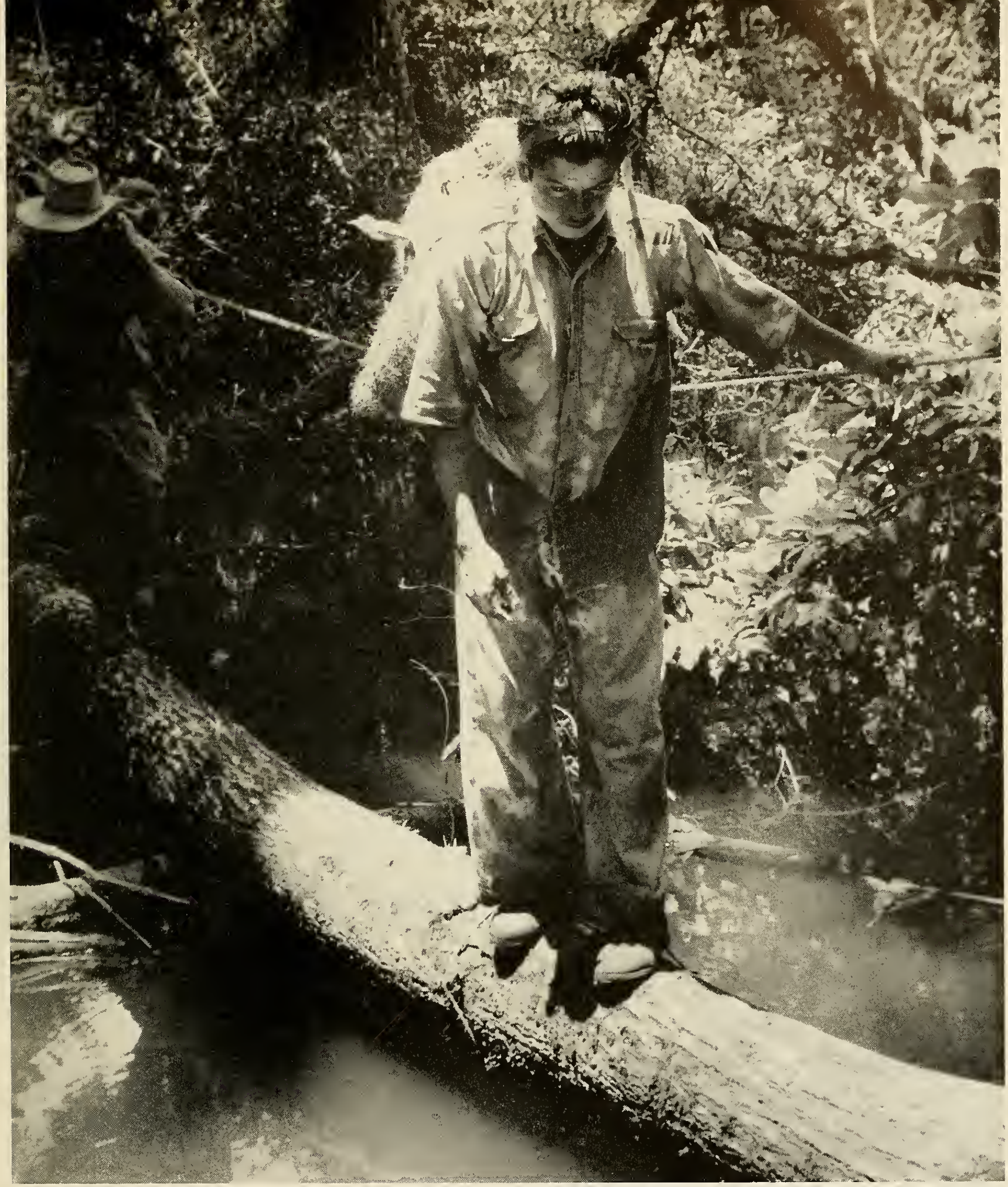
Don Rubén photo

▼ In the fine nursery of Rancho Encanto, hundreds of young mahogany trees were grown from selected seeds. They are permanently replanted, about four to six to the acre

Arthur Stanley Riggs photo

need to inspect what was said to be an unusual stand of mahogany, *chico sapote*, and other trees of marketable timber. As dendrology is not my field, I had to rely for names and data upon the native Indians and upon the kindly superintendent of the Encanto Ranch, a German of long experience in the tropics and so respected by the Indians that he could go anywhere in perfect safety. The Lacandone Indians had given him the nickname Tata Mamal, or "Little Mister Grandfather," by which he was known far and wide. Thanks to his wise and patient guidance, exploration was possible with fewer difficulties than had been anticipated.

The one thing completely overlooked was the temperature of the water for developing and washing films–averaging about 89 degrees F.–and the difficulty of drying the emulsion thoroughly in the prevailing humidity. The river water was clear and cool, tests showing it to average about 68 degrees F. So the first rolls were joyfully set to wash in the swift current. The results were disastrous, for the water carried invisible sharp grains of sand or grit, and the negatives looked as if they had been peppered with shotgun blasts. Then a real washing tray, to be mesh-screened and set in the river, was built of the finest straight-grain

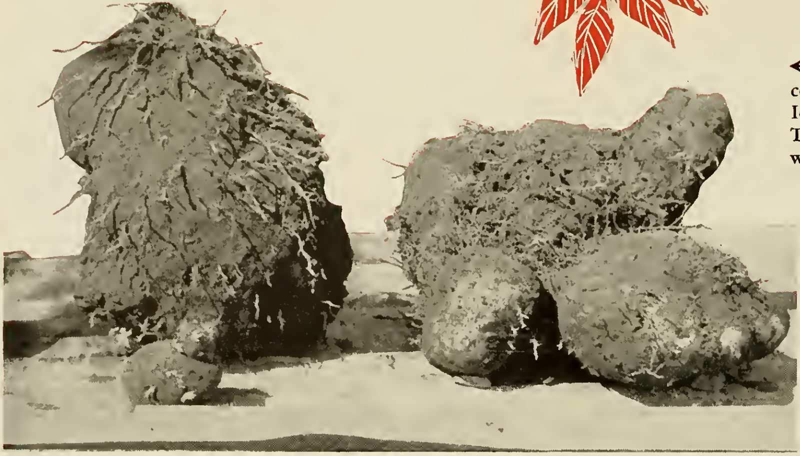


Blom photo

▲ A NATIVE PORTER crossing a river in Chiapas

mahogany and set out to "bleed clean." It "bled" for three full days, the dried sap dissolving in a strong current that stained the river pink for yards. If we would believe a myth that is fairly widespread in Latin America, that particular mahogany must have been felled when the moon was waxing, drawing sap up into the wood. Though there is no scientific proof for this belief, woodsmen in the jungle are apt to wait to fell a tree until the waning moon has had an opportunity to draw back the sap. This is so that the wood will dry more quickly and thoroughly and show less tendency to warp and split.

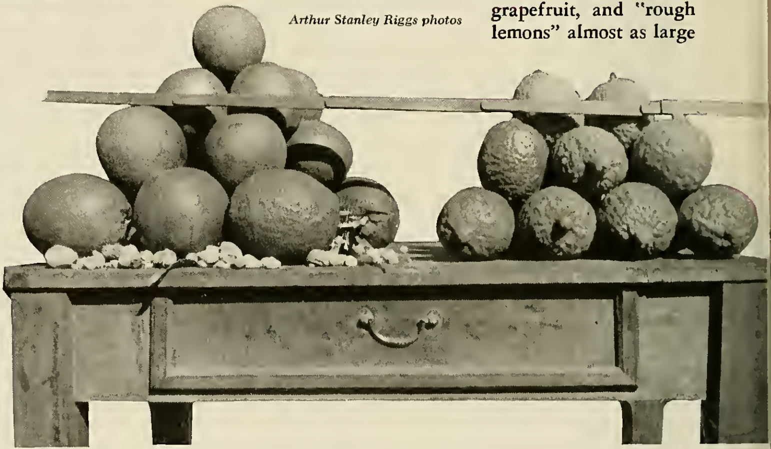
Rancho Encanto is situated about 20 miles west of Palenque. Its broad acres of woodland and jungle, its pasture for the ranch cattle, and its brawling streams for power and light, include typical representatives of every form of life. The big, sprawling ranch house, the store and commissary, and a few outbuildings top a low hill sloping down through pleasant meadows to the little Encanto River. A first experience with what Chiapas can produce was forthcoming the day



◄ A 32½-POUND *batata* compared with a good-sized Idaho potato at front left. The smaller *batata* at right weighed over 19 pounds

Arthur Stanley Riggs photos

▼ ORANGES as big as grapefruit, and "rough lemons" almost as large



after my arrival. Amalia, the Indian cook, told Pedro, one of the boys about the place, to bring her in enough *batata* for dinner. "We feed eighteen," she said.

Half an hour later the boy came back, less than a quarter of one "potato" in one arm, a generous load of split mahogany firewood for the stove in the other. The cook scowled at him.

"Bribón!" she snarled. *"Que estupidez!* [You stupid rascal!] I told you for eighteen. You bring enough for twenty-five!"

Pedro squatted on his haunches, unmoved. "Well, there are the pigs."

Idaho potatoes were the largest I had ever seen, but they seemed like pills beside these hairy-rooted monsters, some of which have been known to weigh up to 35 or 40 pounds. From the true botanical standpoint they are not potatoes at all as we know them but a species of yam (*Dioscorea*). Nevertheless, call them by whatever name one will, they boil, mash, fry, and dice with a pleasing flavor and have a food value that is nothing to sneer at.

Huge as the *batatas* are, they are merely a scale in miniature for measuring other growths. Perhaps 100 feet from the ranch house towered a lofty and beautiful cedar tree, with a royal palm looking like a dwarf beside it. So huge was this tree that when Don Manuel, the Spanish-Indian assistant to the Superintendent, sat astride his big donkey "Saltador"—"Jumper," because he always bucked when saddled—the trunk of the tree extended beyond the animal's head and tail.

No one can explore such a region day after day and week after week without being filled with wonder at the prodigality of nature. Every riverbank for miles is lined with huge reeds looking much like sugar cane and growing to a height of ten feet or more. But this *caña brava* (*Gynerium sagittatum*, as it is scientifically called) is almost pure cellulose. Yuccas grow to astonishing heights and rare beauty. Spiny plants of myriad types, mostly species of *Agave*, provide fibers for cordage. When twisted, they make a rope so hard and stiff that it is almost like wire. Oranges six and seven inches in diameter are common, and "rough lemons" grow almost as large. One tree of unusual beauty and ordinary size is the *achiote—Bixa orellana*, of the Annatto family. A reddish-orange stain is obtained from the arils that cover the seed in the capsule. This coloring agent is reported to have been used by the Mayas for painting their pottery.

But for color, it is the orchid that outshines every other plant in the tropics. We are accustomed only to florists' oversized hybrids, often monotonous in form and color. Besides the river leading south from Salto de Agua to the Encanto River is an old Maya trail six miles long, bordered by forest giants from whose trunks and arms sprout probably a billion or two orchids. Green orchids, yellow orchids; pink-black-green, brown, and purple-saffron-white ones; orchids of every imaginable shade and tint burst from their supporting trees by the cubic yard. They turn the archway of the branches into a weird devil's tapestry of color and shape. Not a flower in the vast array is bigger than a small pea; most of them are smaller, but each is perfectly formed and of rare beauty when examined closely. But en masse they gave me the shivers by their terrific color and repulsive shape.

At the edges of the trail there occasionally rises a straight, slim tree about ten feet high. If you are absorbed in the flowers above, your donkey will gently brush you into this devastating monster. You shriek with pain as its thorns cut through leather legging or boot, and unless the greatest care is taken to prevent infection, serious results follow. Nobody notices the thorns at first. They are flat, double-edged, steel-hard, razor-sharp, shaped exactly like knife blades. They spiral around the bole of the tree screwlike, in regular twists about two inches apart. Tata Mamal's mount brushed him into one, despite his seventeen years' experience in the region. His stout leather legging was cut through, the thorn ran two inches under his kneecap, and he was bedridden for days.

Another reason for high boots or leggings is the snakes. Most of them are harmless, but some are deadly, and as they are more or less provided with protective coloration, they may strike before they are seen. Curiously enough, the barefooted Indians seem to suffer very little from them.

With all the wonders of the jungle crowding about, big trees have to be more than merely large to fix attention. I had seen huge forest monsters in the *bosque* in the Philippines, in Ceylon, and in the Straits Settlements, and I knew something of the ways of the jungle and its conditions. But never anywhere else had I beheld such a seemingly inexhaustible parade of majesty, beauty, rarity, and utility in one region. Of all the different species, the *Swietenia macrophylla* and the *Cedrela mexicana* are the most beautiful, interesting, and commercially useful.

The growth habits of these two great trees are interesting. Both trees are found in very small stands, usually not more than three or four to an acre. The older and larger specimens tower up to as much as 150 feet, with buttresses growing radially 20 or 30 feet from the main trunk and their branches spreading 50 to 60 feet on every side; so it is easy to see why so much space is required. At their feet the jungle sends up thousands of small trees, a matwork of vines, and lush small growth of a thousand sorts. Underfoot the soil is many feet deep in pure humus—the rotted leaves and seeds of untold ages—and in the gloomy atmosphere near the forest floor there is the reeking odor of decaying organic matter. Here and there rises a tremendous mound, often with a great tree crowning its top.

Not infrequently these mounds prove to be the ruins of Mayan structures, swallowed by the jungle and now merely the rooting places of trees much more permanent than the civilization they replaced. The Indians believe treasure is buried in each of these big ruins, and it requires little urging to get them to scrape away the detritus of the ages to uncover intricately carved stones, often rising pyramid-fashion in steps. Scores of such mounds exist on Rancho Encanto, but for various reasons they have never been thoroughly investigated by trained archaeologists.

Shipment of mahogany and many of the other varieties used by cabinetmakers is very arduous and time-consuming, so their effect on the general hardwood market is limited. Practically every river in Chiapas at some point in its course has a *salto* or fall—really a series of abrupt rapids—with a maximum descent of anywhere from a foot or so to perhaps ten feet at low water. The battering the logs get going through the rapids often results in serious splitting of the butt ends, with consequent loss. The answer to that problem, of course, is the importation of big caterpillar tractors with trailer trucks, pre-

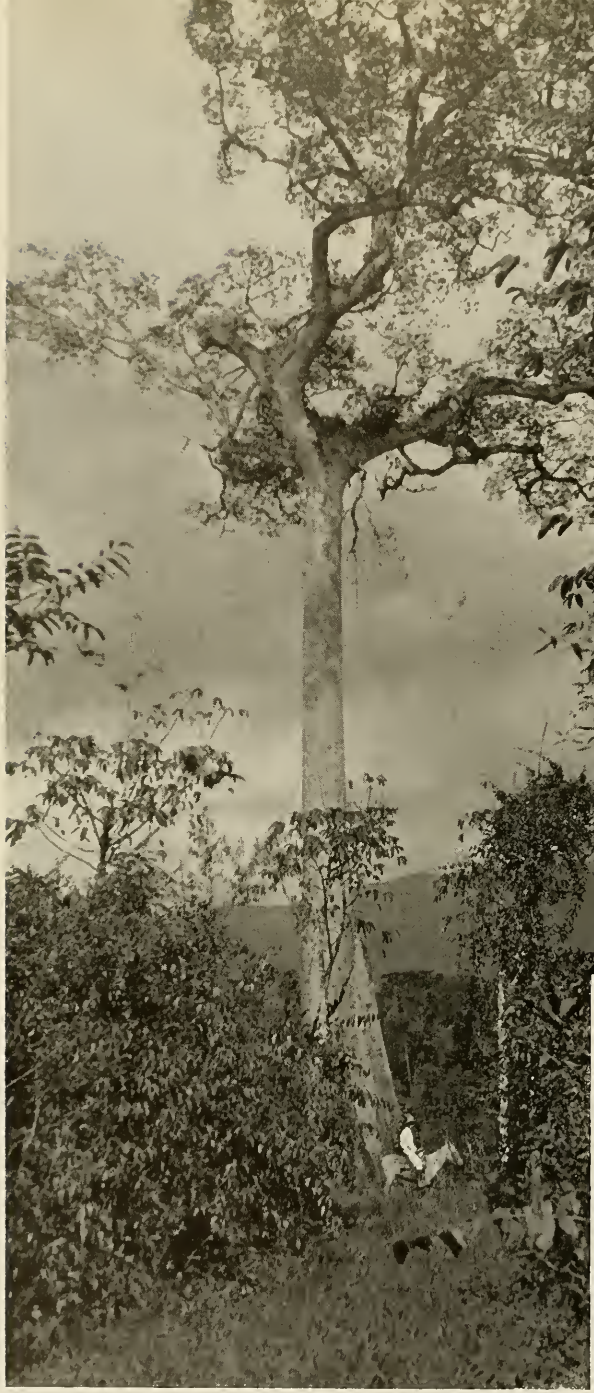
⮟ AT THE FOOT of a tremendous *Tinco* tree. It is about 125 feet high and 12 feet 4 inches in diameter a yard above the ground. *Tinco* wood is very heavy, iron hard, and difficult to work

Arthur Stanley Riggs photo

ceded by bulldozers to clear paths through the jungle to deep water. As that is expensive and recovery of the initial investment requires considerable time, the trickle of mahogany, satinwood, cedar, and other fine woods to the American market will probably remain small for a long time.

Mahogany is propagated by seeds that are contained in small, pear-shaped capsules, and each seed has a gauzy wing. The capsules open while still on the tree, and the seeds are scattered by the wind. Boys are sometimes sent up the trees just before the capsules would naturally open to collect them for nursery planting. They drop the capsules to assistants on the ground, who open them with machetes and remove the seed. The seeds are planted in nursery beds, and the young mahoganies are transplanted before the root system becomes too extensive. Plantation mahogany has never done as well, however, as might be hoped, partly because the nursery trees are severely attacked by the twig borer, *Hypsiphyla grandella.* It causes the tree to assume an "apple tree" form instead of having a strong central trunk.

Once the logs have been sawed into planks, the layman can distin-



Arthur Stanley Riggs photos

▲ A CEDAR TREE rising 75 feet to the crotch. It was about $11\frac{1}{2}$ feet in diameter 3 feet above the ground

➤ DON RUBÉN'S MULE was several feet shorter than the width of this giant cedar

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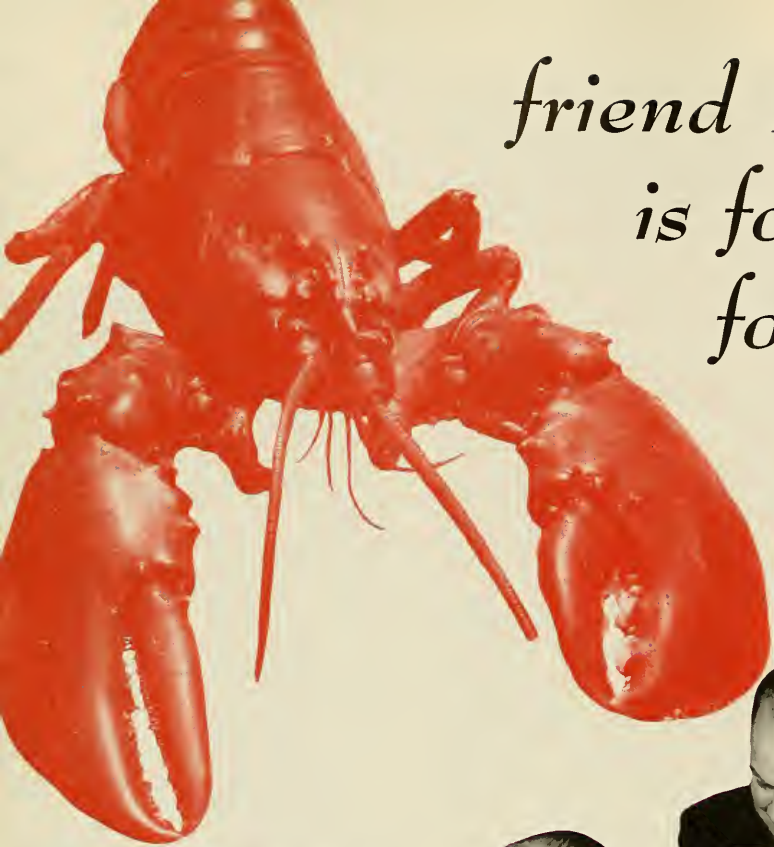
◄ THREE LACANDONES on a "bridge" in the forests of Chiapas

▼ LACANDONES making bows of Guayacan wood in front of a chicle tree in the forests of Chiapas

Copyright by Blom-Duby

guish between cedar and mahogany by the fragrant smell and pungent flavor of the cedar. The cedar is also softer, slightly coarser in texture, and even more brittle than the mahogany. Both woods are easily worked and very durable. They take stain and polish and are adaptable to many purposes, and both bring a high price in today's world markets. Those two trees, though the best known of the tropical hardwoods, are by no means the only useful ones. The *chico sapote* (*Achras sapota*) is an extremely heavy wood, almost iron-hard and reddish or reddish-brown, unless a superficial fungus has made it purple, and it makes indestructible railroad ties, foundation pillars for houses, pilings, and other heavy construction necessities. *Tinco* is so hard it is like metal, but it has a remarkable grain, fine markings, and takes a mirror-like polish. It is also a dark color. Its opposite is the *palo maría* (*Calophyllum brasiliense* Camb.), not the same as the reddish *palo maría* or *Calophyllum inophyllum* of the Philippines. The Mexican tree to which we refer is yellow and, like some other tropical woods, may contain fungal stains caused by stored concentrations of starches and sugars. It is conceivable that modern furniture manufacturers, who have run so toward "blonde" dressers and chests, would find this a most interesting material for futuristic designs. Besides these, there are many others, for we have not yet scratched the surface of the jungle's manifold resources.

I want to go back to Chiapas, in spite of the corns I grew on my hipbones from sitting on the hard bottoms of mahogany canoes over more than 500 miles of turbulent rivers; in spite of the six-inch scorpion that fell with a splash into the basin in which I was about to wash my face one morning; in spite of the heat and the humidity, the stinging black gnats, the *sábalos* that leaped into our canoes from the river and tried to bite us. For there are hollow trees in the dim recesses of the jungle stuffed with 50-pound caches of honey perfumed by exotic tropical blossoms; there are oranges and grapefruits one can "swim in"; there are big *tigres*—jaguars—that steal pigs literally from your doorstep at night. There are waddling turtles that lay eggs on the riverbanks while fiery-hued macaws scream at them. Yes, and roasted armadillo tastes every much like sweet young chicken-flavored pork. Chiapas . . . naturalist's paradise.



friend Lobster is food for thought

By
N. J. Berrill
McGill University

"AND towards night we drew with a small net of twenty fathoms very nigh the shore; we got about thirty very good and great lobsters . . . which I omit not to report, because it sheweth how great a profit the fishing would be . . ." So wrote Waymouth in the journal of his voyage to the coast of Maine in 1605.

Three and a half centuries later the Maine lobster fishing is still good, though the days of the "great" lobster are gone. Intensive fishing and close regulation, in effect for many years now, have prevented all but a very few lobsters from reaching any great age or size. I have risen before dawn and been out with the lobstermen, and it is seldom that a string of their traps will get them a catch with more than half the lobsters in it of legal size or over. But big lobsters or small, state regulations and canny down-East shrewdness have kept the Maine lobster industry in a robust condi-

Ewing Galloway photo

▲ SERVED IN PROPER STYLE: caught yesterday, flown to market, and cooked today —the favorite dish of many Americans, inland as well as along the seacoast

He may look clumsy and unresourceful, but can *you* put new sand in your balancing organs when they become empty?

tion, whereas neighboring Massachusetts caught and ate up their local supply long before the Civil War. Nonresidents of Maine were prohibited from catching lobsters as early as 1823, and though I can sit on a rock at the end of my own Lobster Cove near Boothbay Harbor and call it my own, I cannot set a trap and I cannot touch the lobster buoy within reach of my hand—I'm a summer resident.

Lobsters took a beating when canning them was in vogue. There was a nine-inch law that tried to save them, but nine inches barely permits a lobster to grow big enough to produce eggs; and the industry, as usual, was trying its best to commit suicide by carefully avoiding the slightest pretext at conservation.

The ten-and-a-half-inch law, passed in 1895, produced a revolution. Lobster canning folded up overnight, lobsters spawned in increasing numbers, and the fresh-lobster industry began a boom that today has about 6000 lobstermen fishing up and selling as many as 19 million pounds of lobsters in a year. That is, about 17 million lobsters were caught during the best year in the last decade. The State began an annual purchase of from 20,000 to 40,000 seeders, or egg-bearing lobsters, for planting and several thousand more for hatcheries. The importance of this is simple: a lobster in its first egg-laying season carries 9000 to 10,000 eggs, but if it lives long enough, it may carry as many as 100,000 at a time. So protection is given not only to young adults but to older lobsters if they have stayed out of the traps for a few years more. They have then become too valuable as egg-layers for anyone to be permitted to catch and sell them. In other words, it pays to let the older ladies live.

◆

Age and growth do queer things to a lobster. Claws and body grow at different rates, and in a very small lobster the claws are hardly worth the picking. The larger the lobster grows, the larger grow the claws, not at the same rate but faster, until at last, in those giants you sometimes see in public aquaria but never in the fish market, the unbelievable happens and the tail wags the dog. The giant of them all was a lobster that weighed *thirty-five pounds,* as heavy as a child in a nursery school, with claws alone weighing more than two-thirds of the total. It is a wonder that a lobster can feed itself with such cumbersome weights to lift, though when an animal lives in water, its weight is only the difference between its weight in air and the weight of the same volume of water. All the same, such a lobster is quite a sight, a lumbering tank that moves slowly and no more than it must, which is not much.

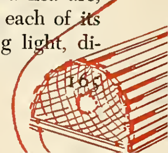
Freshly-caught lobsters do not always go straight to market. Most lobstermen keep a small "live-car" afloat near their moorings, and the tidal pounds up and down the Maine coast can keep about five million lobsters more or less happily waiting for the right price. They are fed mussels, though the lobsters do what they can to supplement the monotony by digging, shucking, and eating the clams generally found in the muddy bottoms of the pounds. The idea of impounding lobsters behind a barrier that lets the greater part of the tide in and out but holds the lobsters behind bars is by no means new. The French took such matters seriously long before the rest of us. I remember a visit to a famous marine biological research laboratory at Roscoff on the north coast of Brittany, where ancient lobster pounds were operated by the town and hundreds of thousands of lobsters awaited the Paris market.

On this continent, along the middle and east Atlantic coast, you get the American Lobster, with its great claws. The Spiny Lobsters of several sorts, all much the same, are found throughout the tropical waters as well as in the Southern Hemisphere and along our Pacific and southern shores. In Europe, besides Spiny Lobsters, you find the quite different little Norway Lobster and also the *homard* of the French gourmet, which is very similar to the American Lobster. In that little French town, I had them all, one after the other or all at once—the Norwegians piled high like shrimps, the Spiny ones as stew, and the *homards* as straight lobster. But it was the heavy, brittle shell of a Norway Lobster that cut my finger to the bone, and I know those lobsters by sight, smell, and taste and by touch and pain.

The table is no place, of course, to study what food was like when it was alive. But if you are tough-minded or can get a lobster onto your lap before it gets into the pot, it is worth-while looking at it for what it is—a marvelously-fitted piece of machinery designed for living.

We are inclined to take our commonplaces for granted. A lobster has a front and a back end, eyes, a heart, and some kind of a brain. "Naturally," you might say, yet it's not "naturally." A starfish or a jellyfish has none of these. The shape of a lobster means that it goes forward or backward but not sideways like a crab. Primarily, it is built for moving forward. But the shape of the body (streamlined toward the tail), the powerful muscles of the tail itself, and the broad fan at the end of the tail are all directed toward fast, sudden movement to the *rear* as a means of escape.

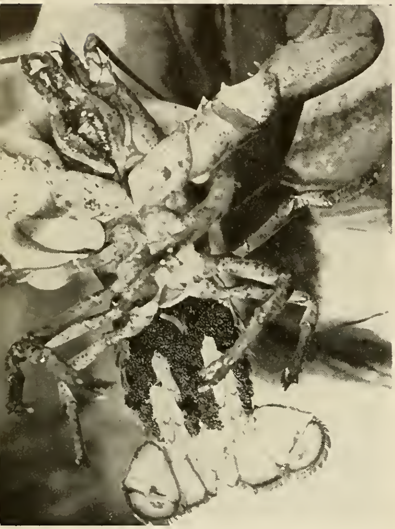
The place for the pilot of a ship or a plane is on the bridge or in the cockpit. A lobster or a fish has its navigating instruments at the front end, too, with the central brain control immediately behind. Everything is in pairs, for direction finding and for operational control. Fish and lobsters are not relatives, at least no more than you and a flea are, and yet each has eyes, each of its own kind, for supplying light, di-



▲ A Maine lobster fisherman, setting off in early morning to haul trap line

Three Lions photo

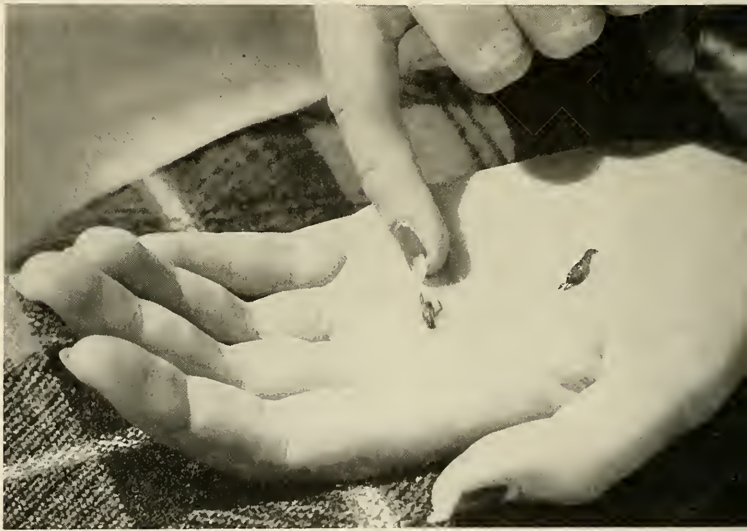
▲ Lobsters are trapped in "pots" like this, which rest on the bottom and are located by floats



◄ A female seed lobster with eggs under the tail at the incubation stage

▼ Fifth stage or fifteen-day-old lobsters from the Rearing Station at Boothbay Harbor. At each stage the lobster sheds and grows a new shell. Even a 35-pound lobster once looked like this

Photos from the Dept. of Sea and Shore Fisheries on the Maine Development Commission



rection, and images. Each can touch, smell, and taste—an intimate contact with the watery world without. And both respond to gravity.

Most animals that swim, run, or fly have what seem to be gravity organs, all very much alike—small sacs of sensory tissue enclosing little heavy stones that shift about as the animals move. Lobsters and their tribe have a pair of sacs that appear to serve the same purpose. But they are unusual. They are not closed sacs but are depressions of the outer surface of the body; and instead of growing its own stones, or weights, the lobster picks up sand grains from the bottom and places them in the cavities.

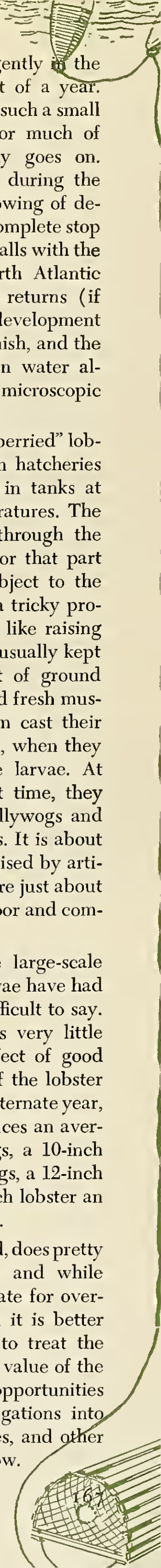
Surely these organs looked like gravity instruments, but appearances can be deceptive, and biologists have to be careful in their deductions. Fortunately, experimental proof was possible.

A lobster sheds its skin periodically. This includes more than you would think—not merely the shell or skin of the outer body, claws, and legs but the lining of the stomach and intestine and the lining of these balancer sacs. Whenever this happens, the soft-shelled lobster has to insert a fresh supply of sand grains to replace those lost with the old skin.

The information that these organs are for balance is more than guesswork and comes from a trick someone once played on the lobster's relative, the prawn. The trick was obvious enough when you read about it but a stroke of genius at the time. Iron filings were made available in place of sand. The prawn put some into its sacs without knowing the difference, and apart from inevitable rusting, I imagine it would have gotten along perfectly well. But iron filings respond to a magnet whereas sand does not, and the pull of a magnet is like the pull of the earth. A mag-

Three Lions photo

▲ **One claw** is a crusher and the other a cutter. The crusher is more often on the right; but sometimes you see a "south paw," as shown here



net was held over the head of the prawn, which was swimming through the open water where it could not orient itself by its other senses. The filings flew up toward the magnet and pressed against the part of the sacs normally stimulated only when the creature was upside down. It reacted according to information received and proceeded to turn over. It did not turn clear over because the magnet did not completely mask the effect of gravity, and the prawn responded to the resultant of the two forces.

Look for a moment (if the lobster is still on your lap) at its lower side. The animal has five pairs of "legs," four of which are used for locomotion. The other pair has evolved into enlarged claws for feeding. And please notice that one claw has become a crusher and the other a cutter, as though to prove that a knife and fork are better than two knives. Even after the food has been cut up into small pieces, the lobster handles it in a most delicate way, using as many as six pairs of jaws or jaw accessories to get it into the narrow gullet. More than that, when the food does reach the stomach, the gastric mill, with its teeth, rods, and muscles, grinds it up with the digestive juices.

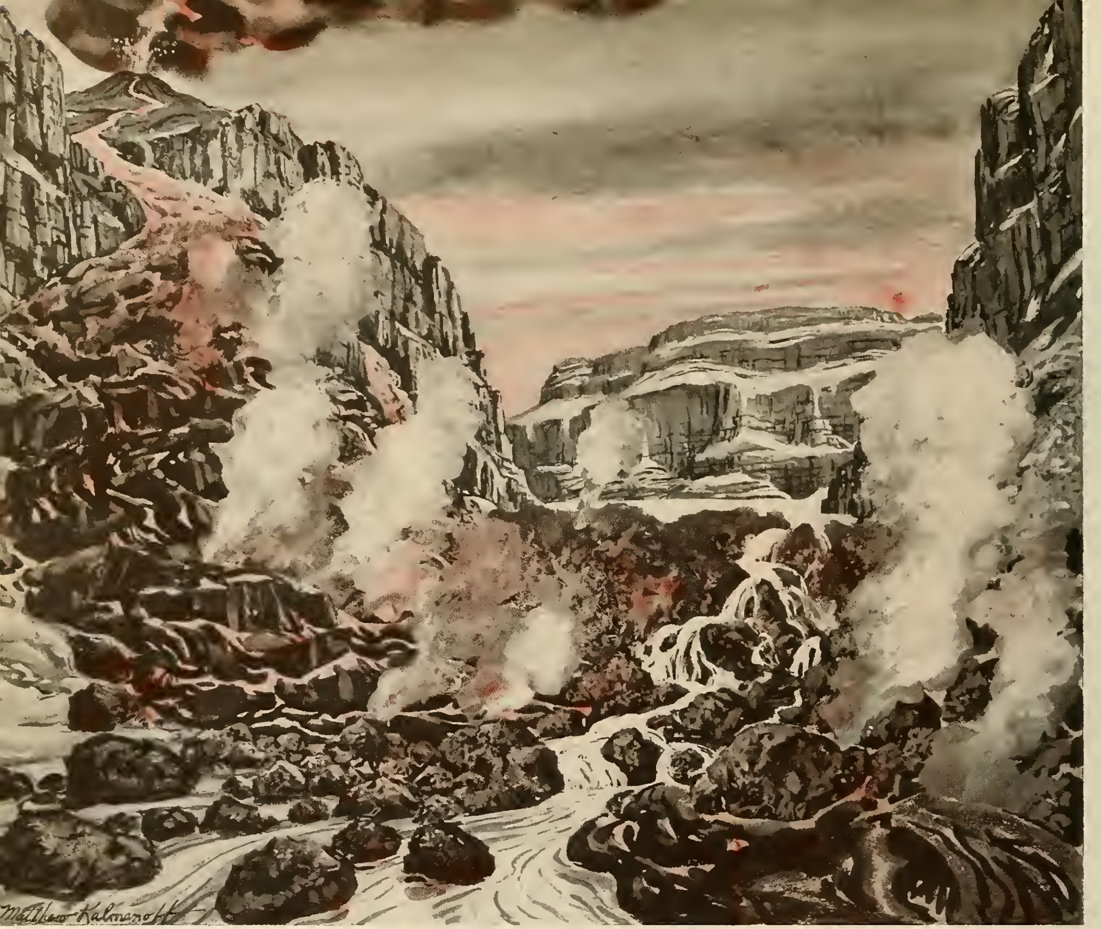
So much for food; what about oxygen? Blue blood needs oxygen as much as red, and gets it through the gills. These are cream-colored, feathery structures hidden from view beneath the armor at the sides of the body, and water is bailed through them continuously. These gills have an interest quite apart from their respiratory function. Each grows from the base of a leg, and each leg unit is a double feature, one branch for breathing and another for walking. It is as if your shoulder muscles operated not only your arms but a pair of wings you may be hoping to sprout one day. The image that comes first to my mind is of a one-man band I saw not long ago, with hands and forearms working an accordion, and drumsticks fastened to the elbows beating a drum on the man's back.

Double duty seems to be a lobster commonplace. The appendages beneath the tail have different things to do at different times. They are called swimmerets, which tells something about them. When a lobster wants to move forward when its legs are off the sea floor, the swimmerets paddle in a regular rhythm and the animal actually swims. This is their main purpose, but another use has crept in. When it comes time to spawn, the eggs are fertilized with sperm stored for anything from a few minutes to two years in pockets behind the legs. Then the eggs are glued to the swimmerets, and there they stay until they hatch, rocked gently in the water for the best part of a year. It seems a long time for such a small egg to develop, but for much of the time little actually goes on. There is a quick start during the first summer, then a slowing of development almost to a complete stop as the sea temperature falls with the bitter cold of the North Atlantic winter. When warmth returns (if you can call it that), development speeds up to a quick finish, and the young lobsters hatch in water already teeming with the microscopic life they need as food.

For many years the "berried" lobsters have been kept in hatcheries and the larvae reared in tanks at relatively warm temperatures. The idea is to rear them through the free-swimming stages, or that part of their life that is subject to the greatest dangers. It is a tricky procedure and very much like raising fish fry. The larvae are usually kept in the tanks on a diet of ground beef and liver or ground fresh mussels, until most of them cast their skins for the third time, when they are called fourth-stage larvae. At this stage, for the first time, they look less like small pollywogs and more like small lobsters. It is about as far as they can be raised by artificial means, and they are just about ready to seek the sea floor and comparative safety.

But what effect the large-scale plantings of lobster larvae have had through the years is difficult to say. In all probability, it is very little compared with the effect of good restrictive regulation of the lobster industry. For in every alternate year, an 8-inch lobster produces an average of about 5000 eggs, a 10-inch lobster about 10,000 eggs, a 12-inch one 20,000 and a 14-inch lobster an average of about 40,000.

Nature, man excluded, does pretty well when left alone, and while hatcheries do compensate for overfishing to some extent, it is better to cure the evil than to treat the symptoms. The greater value of the hatcheries lies in the opportunities they afford for investigations into the life history, diseases, and other things we need to know.



Drawing by Matthew Kalmenoff

Where Lava DAMMED THE COLORADO

Near the most breath-taking view in the Grand Canyon, the vacationist can see where a mighty cataclysm once challenged the world's most imposing river

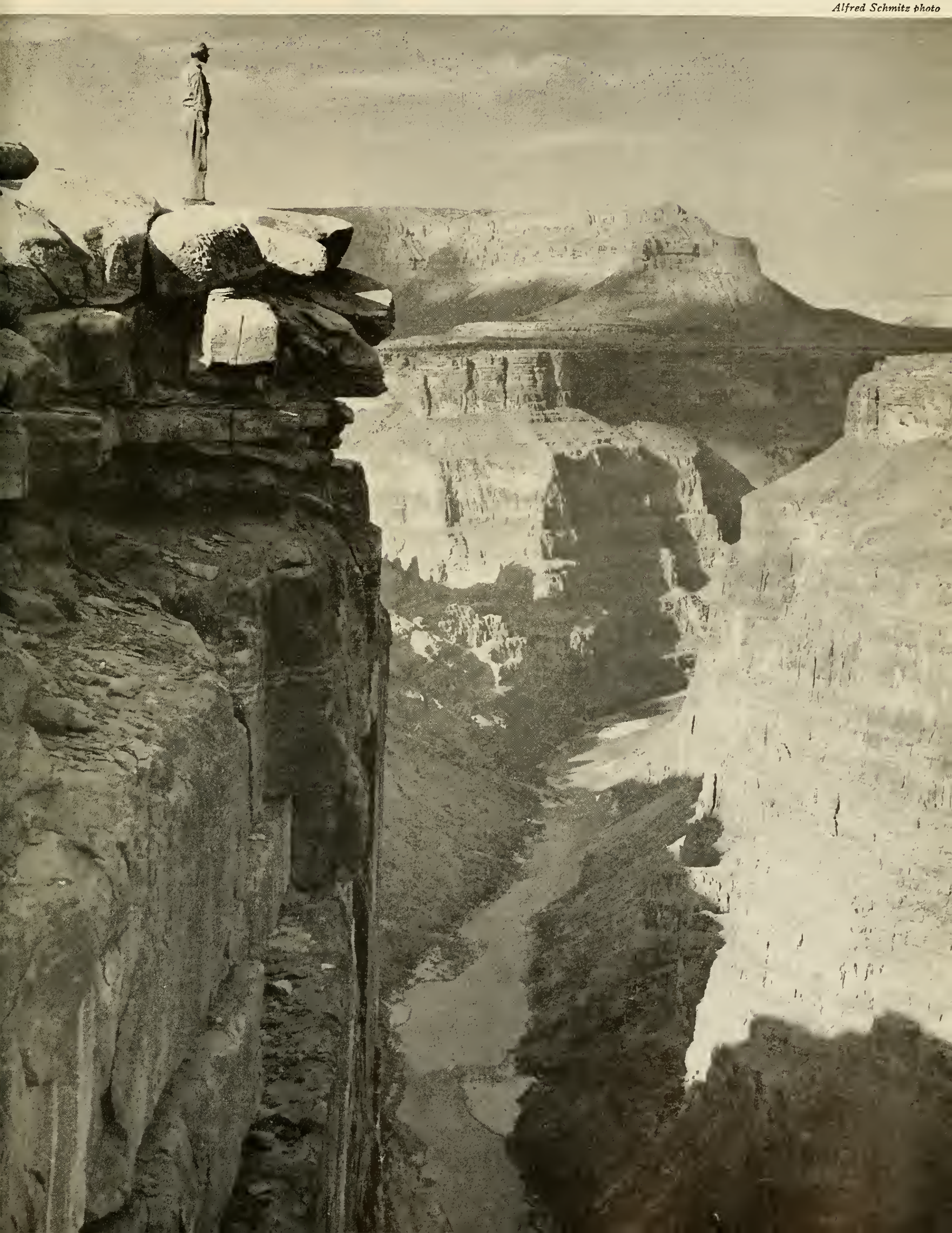
By Philip Ferry

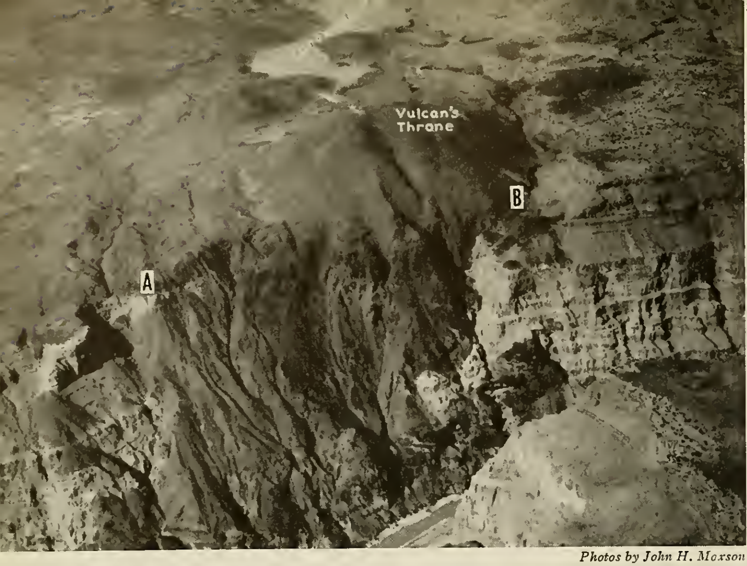
THE whole world knows about Grand Canyon National Park and its prize exhibit, the Grand Canyon of the Colorado River. Only a small segment of the world's population has heard of Grand Canyon National Monument, which adjoins the Park on the west. The two form a continuous natural preserve which borders on 100 miles of the famed canyon. Together with the Lake Mead National Recreational Area, which bounds the Monument on the west, they comprise a 200-mile strip of federally-administered national playland.

On most maps the Park and Monument appear as one. Actually, the Colorado River divides the two, with the greater part of the Park south of the river and most of the Monument on the North Rim of the great gorge. Because of its geographical position, the Monument offers a unique perspective of the

▼ 3000 FEET STRAIGHT DOWN: Toroweap Point, overlooking the Inner Gorge of the Grand Canyon. This is the most sensational view point in the entire Grand Canyon system. A strong pitcher can hurl a rock into the river—but don't swing too near the edge!

Alfred Schmitz photo




Vulcan's Throne
B
A

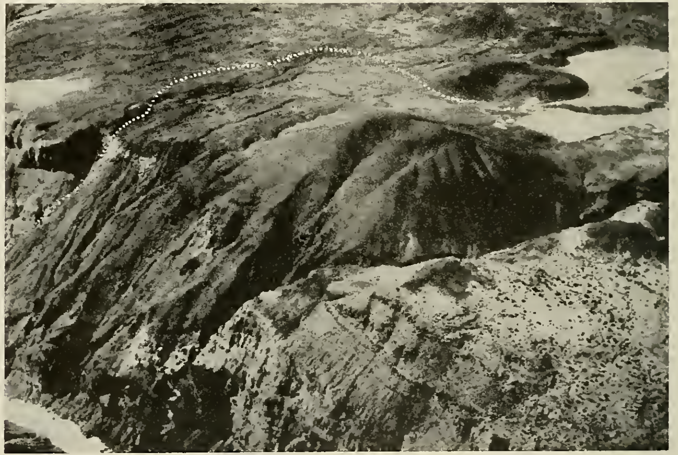
Photos by John H. Moxson

canyon that is known to only the most seasoned desert travelers.

Toroweap Point (pronounced Tor-o-weep) is the ultimate in scenic spots, but up to the present it has remained almost a legendary place. The condition of the road has kept all but a few motorists from hazarding a visit. This circumstance need no longer be a deterrent. True, the final six miles, from Toroweap Ranger Station to Toroweap Point, would be impassable in rain, but a car with a high ground clearance is perfectly safe in dry weather.

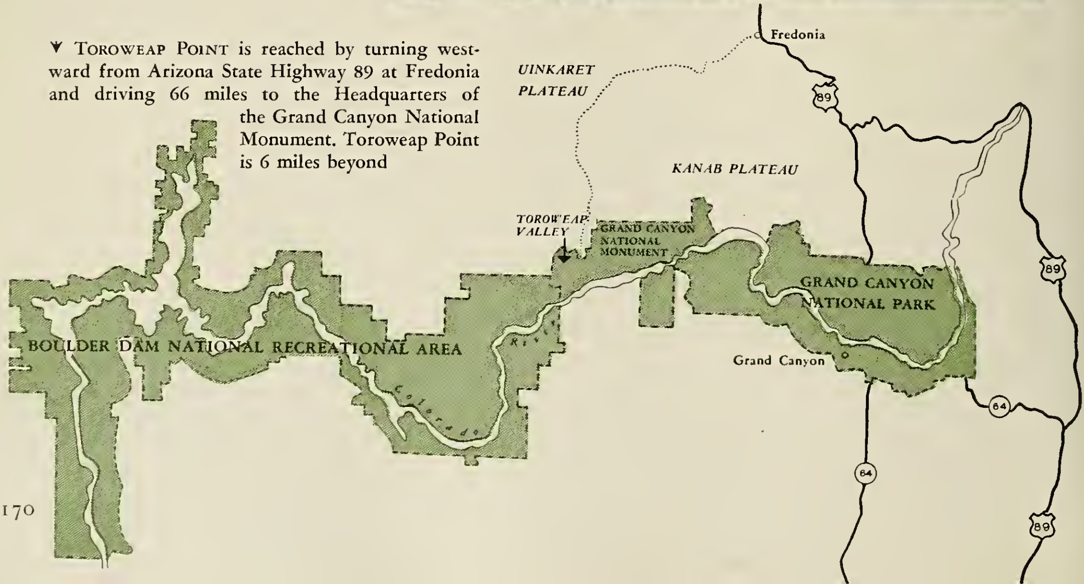
Our suburban carryall, with its high clearance, heavy-duty tires, and truck transmission, encountered no difficulties whatever, although we found the road exceedingly

⮝ An aerial view looking northward across the Grand Canyon. Molten lava, flowing through Toroweap Valley (then a gorge), poured into the Grand Canyon between points A and B to produce what is now called Toroweap Cascade. The 600-foot dam was in time erased by the Colorado River



⮞ From the southeast, with Vulcan's Throne in the center: an aerial photograph showing the route the author's party took from dry lake in Toroweap Valley, across the lava field, and down Toroweap Cascade to the Colorado River

⮟ Toroweap Point is reached by turning westward from Arizona State Highway 89 at Fredonia and driving 66 miles to the Headquarters of the Grand Canyon National Monument. Toroweap Point is 6 miles beyond


Fredonia
UINKARET PLATEAU
89
KANAB PLATEAU
TOROWEAP VALLEY
GRAND CANYON NATIONAL MONUMENT
GRAND CANYON NATIONAL PARK
89
Grand Canyon
64
64
89
BOULDER DAM NATIONAL RECREATIONAL AREA
Colorado River

dusty. Also, it was barricaded at intervals by closed cattle gates that required individual opening and shutting. It is only the last six miles that would stop a low-slung car. Technically, this section is not a road but a pair of primitive wheel tracks. However, the motorist who has gone this far is not likely to be turned back by this typical bit of unimproved desert road. Certainly the rewards at the end justify the undertaking. Our party of three—which included Alfred Schmitz, photographer, his wife Virginia, and me—felt amply compensated when we visited Toroweap in May of 1950.

Toroweap Point perches spectacularly on the brink of the Colorado River's Inner Gorge. This is the sheerest part of the Grand Canyon and the section where the two rims come closest together. From the Point, the spellbound spectator looks down 3,000 feet to the waters of the Colorado and gasps at a view that is surely one of the most spine-tingling in all the world. Here the great Colorado, heavy with its burden of mud and silt, looks motionless, except for the distant rapids of Lava Falls. Oddly enough, it is difficult to determine just what makes the sight so spectacular. Toroweap Valley is only 3,000 feet above the river, and there are other spots along the two rims where the canyon is much deeper. But it is a fact that the view from Toroweap Point is one to send a thrill through even the most casual observer. Virginia's comment, after a single glance into the abyss, was terse but descriptive.

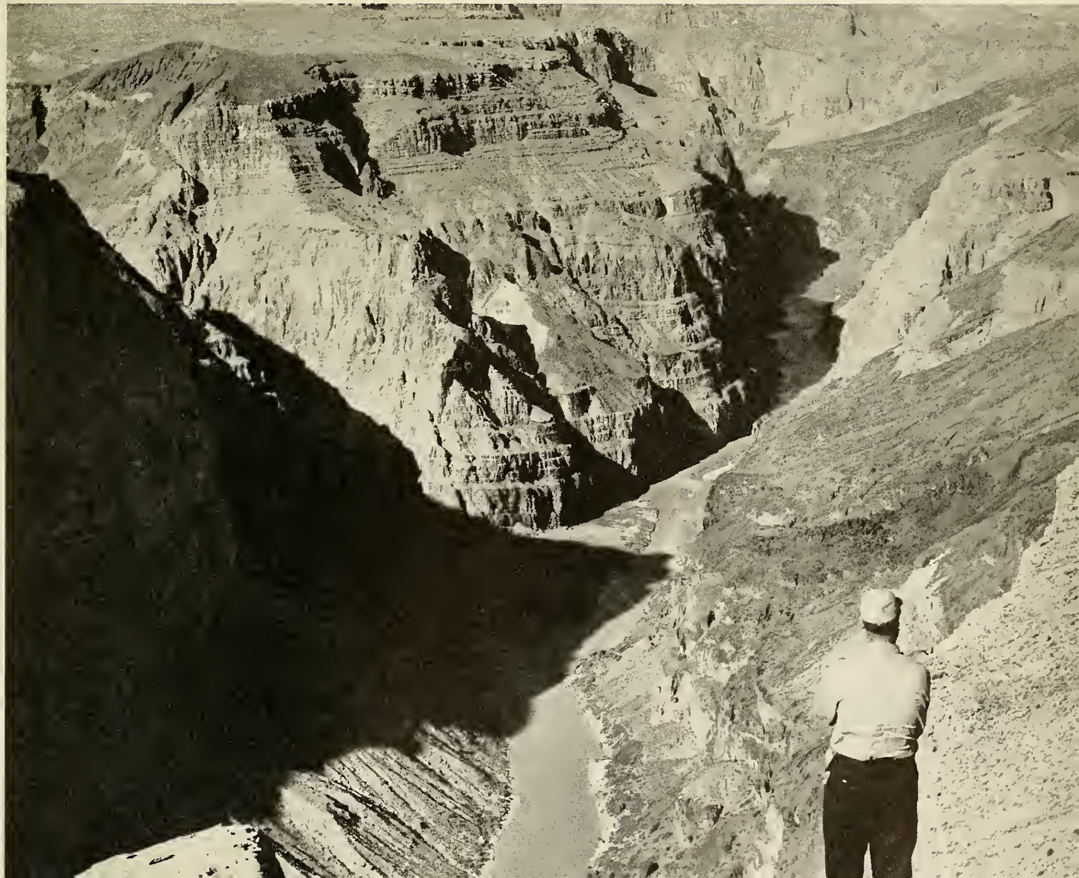
"It scares the breath out of me."

Lou Garrison, Assistant Superintendent of Grand Canyon National Park, believes it is the sheerness of the walls that creates the illusion of excessive height. Elsewhere along the two rims, the view is across a series of sunken plateaus and mesas. Here one looks directly down into the river. Garrison points out that a person with a strong throwing arm can cast a stone far enough out from the rim to clear the canyon wall and reach the river below.

At the Point, one is conscious of a powerful updraft surging from the canyon. Birds utilize these air currents to go zooming over the Point. They sail overhead like ghost wraiths, the swishing of their bodies plainly audible though the birds themselves are often moving too swiftly to be seen. Cliff swallows, ravens, the melodious house finches, mockingbirds, and two species of hummingbirds can be seen in the area. Most of them, except the leisurely-soaring raven, sail over the mesa like jet projectiles, singing and

▼ **Toroweap Cascade** is the black mass of lava beyond the standing figure. It drops 3000 feet from the floor of Toroweap Valley to the canyon bottom

Photo by Alfred Schmitz



calling as though such seemingly uncontrolled flight were the most joyous experience life could offer.

Toroweap Valley is a celebrated volcanic zone. The entire plateau is scorched by lava flows, pockmarked by volcanic bombardments, and singed by fallen ash. The cinder cones that rim the valley on the west side form the most characteristic geological feature of the Uinkaret Plateau.

Toroweap Valley is a filled-in canyon, about three and a half miles wide and sixteen miles long. Parts of the walls of this ancestral Toroweap Canyon are clearly discernible. Material eroded from the side walls, together with the detritus carried down the canyon by floodwaters, gradually filled the old canyon, forming the present valley. Near the canyon rim this fill is as much as 2000 feet thick. The attractive name, Toroweap, is from the Paiute word for greasewood. The floor of the valley abounds not only in greasewood but also in yucca, cactus, sagebrush, nolina, and the tall-stemmed agave *(Agave utahensis)*. Until fairly recent times the Paiutes frequented the valley in spring to pick the fruit of the agave, or *yant,* as the Indians call it. The fruit was roasted in stone roasting pits, whose smoke-blackened remains are still to be seen in the valley.

Photo by Alfred Schmitz

▲ VIEW from Kanab Point, another spot on the North Rim. A small stretch of the muddy Colorado is seen in the bottom of the canyon

The geological history of the Toroweap area is similar to that of Grand Canyon National Park, but there has been visible alteration in more recent times. After the principal topographic features of the area had been developed and the side canyons cut, volcanic activity began. Great quantities of molten lava poured from the scores of volcanic craters and flowed down the slopes, changing the topography and building the 30-mile Pine Mountain Range, or Uinkaret ("Region of Pines"), to give the Paiute name.

The dominant peak of the region is Mount Trumbull, which rises 2000 feet above the surrounding plain and provides a convenient point from which to survey the geological features of the region. The mountain was named in honor of a U. S. Senator by Major Powell of Grand Canyon fame. From its summit nearly 170 craters may be sighted in a view that encompasses 40 miles of the North Rim country. Major Powell climbed the volcanic mound in 1870 and was moved to the following rhapsodic comment:

"Oh, what a view! A vision of glory! The Vermillion Cliffs to the north, with their splendor of colors; the Pine Valley Mountains to the northwest, clothed in mellow, perspective haze; unnamed mountains to the southwest, towering over canyons, bottomless to my peering gaze like chasms to the nadir hell; and away beyond, the San Francisco Mountains, lifting their black heads into the heavens."

The observer of today, unless he be a geologist, is not likely to be inspired to Powell's fervid prose, but he can nonetheless comprehend the extent of the volcanism that has convulsed the region. Southward from Trumbull is a particularly weird spot known as the Witch's Water Pocket. This is a broad, desolate waste where the lava is so rough, black, and jagged that it appears to have flowed within recent times. It has the appearance of a frozen sea of lava whose waves have been transformed into petrified black foam.

Early in the volcanic history of the region thick rivers of lava flowed southward, filling a deep, narrow gorge that once dissected the floor of Toroweap Canyon. The molten masses flowed 1500 feet along the valley floor, fanned outward to the brink of the Grand Canyon, and finally poured over the rim to the river below. Today the black masses stand out in marked contrast to the light-colored underlying layers of sedimentary rock that show between the various flows.

The lava cascades have been described by geologist John H. Maxson as the most spectacular recent geological feature of the western Grand Canyon district. The westernmost plateaus, the Shivwits and Kanab plateaus, as well as the Uinkaret, all display extensive fields of these basaltic lavas. Perhaps the most vivid reminder of the region's volcanic past is the long fill known as Toroweap Cascade. This is the spot where the fluid lavas poured into the Inner Gorge, choking the river channel at the junction of Toroweap Valley and the Colorado and erecting a 600-foot dam that stopped the flow of the river. When eruptive activity ceased, the water of the Colorado, heavy with its burden of sand, silt, and gravel, began eating away at the dam. Time has given the victory to the river. The Colorado has worn away the lava barrier and again flows unhampered through the mighty gorge. Evidences of the old dam are plainly visible today, patches of the lavas clinging to the walls on both sides of the canyon.

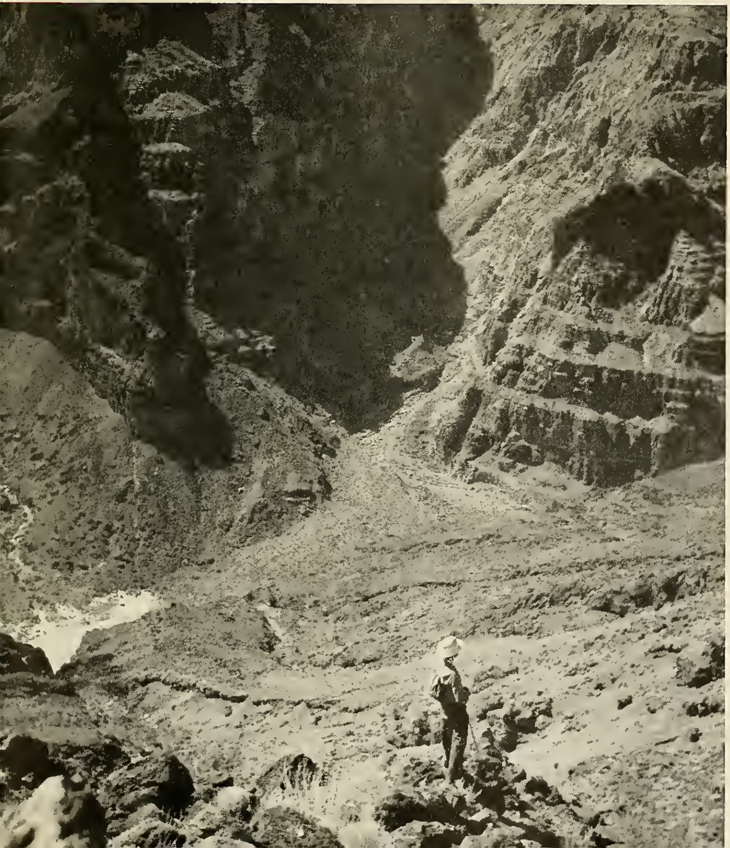
Perched on the brink of the valley, near where the lava cascaded into the gorge, are spectacular remnants of the volcanic activity of geologically recent times. On one side stands a 600-foot basaltic cone called Vulcan's Throne, one of the scores of small volcanoes formed in the area by the piling up of ejected materials. At the west base of Vulcan's Throne is the Toroweap Cascade, the break where the molten masses poured down the canyon wall and dammed the Colorado.

The most spectacular feat and certainly the most exhausting undertaking in the Monument is the descent of Toroweap Cascade to the Colorado River. This route permits one to enter the precipitous Inner Gorge from the canyon rim without benefit of a trail, a feat impossible at any other point within the Monument. Many persons have made the descent over the years, but practically none cares to repeat the performance. The only exception appears to be John Riffey, Park Ranger. Riffey makes the arduous trek every time he gets the chance. Some hardy hiker need only propose the undertaking and Riffey is off like a wild bee making for a honey tree. Mrs. Riffey does her best to discourage these acrobatic feats, declaring it takes Riffey two days to recover from the strain. The Ranger himself considers the stunt only an average day's workout and feels that he is getting soft if he permits any excuse to deter him from the trip. Mrs. Riffey did succeed in discouraging Virginia from attempting the trip.

The Riffeys are the sole residents of Grand Canyon National Monument and preside over a 200,000-acre preserve, which attracts at most 200 visitors a year. Disclaiming any semblance of loneliness in their isolated domain, Mrs. Riffey says, with a touch of humor, "We have lots

▼ **Ranger John Riffey** pauses in the descent of the lava cascade for the first close view of the Colorado. The vertical outcropping seen on the left wall is the remnant of the lava dam that once blocked the mighty Colorado

Photo by Alfred Schmitz



Photos by Alfred Schmitz

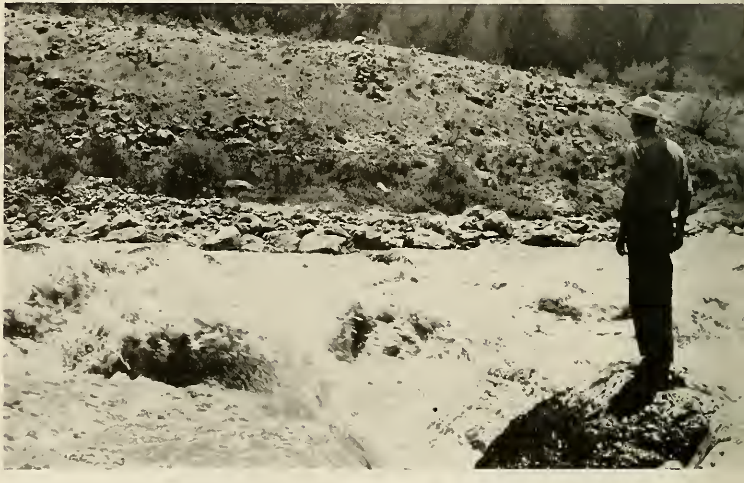
▲ WHERE the lava cascade met the Colorado

of neighbors, but all of them are four-footed."

Riffey, tall, rail-thin, and Colorado-born, is a graduate of Colorado A. and M. For a man in his thirties, he has had a diversified career, including several seasons in the Forest Service, two years of teaching school, and two years in the Army. He has been in his present post a total of six years, having held the position for a time before going into the armed forces. This is the post he likes best. He is sole monarch over a domain that stretches 30 miles from east to west. One of the great attractions of the job is that it permits him to take off on unannounced expeditions into remote corners of his preserve whenever the least excuse presents itself. Finding us willing accomplices, he proposed a side trip to the easternmost extension of the Monument to see what Riffey and other National Park Service men term the most unusual panorama of the Grand Canyon obtainable from the North Rim. Since his ancient Park Service truck was not equal to the rough trip, he suggested we use Schmitz's carryall, an arrangement that would enable him to make a tour of inspection of the area and at the same time take us into a seldom-visited part of the North Rim country.

The section Riffey aimed at was Kanab and Boysag points, two promontories that jut into the Grand Canyon in an area some 50 miles south and east of Fredonia, Arizona. Since the two points are off the beaten track and are approached over primitive roads utilized solely by sheepherders' wagons, it is little wonder they have been neglected.

The five of us, including Ranger Riffey and his wife, climbed into the carryall and began the spine-shattering drive to the east. Leaving Riffey's headquarters at Toroweap Valley, we bounced over 50 miles of sagebrush plain, which were relieved at intervals by clumps of cliff rose and Apache plume. As Riffey had foretold, the views from the two points are unlike any others on the North Rim. Here one sees mostly the land surface of the great gorge—the mesas and side canyons—and little of the river. The prevailing hue is an apricot shade, and the great sunken plateau is as irregular as a jigsaw puzzle. Viewed from the rim, the river is insignificant and fills an infinitesimal part of the canyon's area. Here the stream takes second place in interest to the canyon, which is not a single abyss but a series of chasms, each of major proportion. While the eye takes in a 40-mile sweep, only a mile or two



of the river is encompassed. The view is so extensive that at Kanab Point one can look eastward into the Thunder River country,[1] and at Boysag, the view is southward into famed Havasu Canyon.[2]

Actually, what the eye sees is too extensive for ready comprehension, and one is soon surfeited with canyon scenery. Perhaps the individual, dwarfed by the scene before him, subconsciously resents having to play a secondary role even to such a stupendous work of nature. The 100-mile round trip was a full day's excursion and left the party pretty much wilted. However, a good night's sleep found us ready for our major undertaking in the valley—the descent of Toroweap Cascade to the Colorado River.

After Riffey had established his regular daily radio contact with the South Rim across the canyon, we took off in his half-ton truck. The approach to the head of the cascade circles the west base of Vulcan's Throne. Riffey parked the truck at a dry lake in the valley, and we plodded across a mile-long tongue of volcanic detritus consisting of black ash and large basaltic blocks. Turning the west shoulder of Vulcan, we found ourselves at the incline where the lava had gone cascading into the river. This is the roughest and surely the most dangerous course down to the river but also the most rewarding, since it follows a route of great scientific interest. On all sides are evidences of the extreme volcanism that rocked the region in ages past. Prior to the extrusion of the lavas, a canyon was cut along the Toroweap Fault leading from Toroweap Valley into the Grand Canyon. Flow after flow of lava and basalt poured down this gulch through the centuries, filling up the mouth of the former Toroweap Valley. Today the black lava stands out like smudge on drifted snow and fills the gorge like coal that has been dumped down a chute. It is jumbled in utmost confusion, and it tumbles down the wall at an angle of perhaps 35 degrees, a slope that adds to the hazards of the descent.

Present-day geologists recognize four distinct stages in this volcanic

Photos by Alfred Schmitz

⮝ **White water** of the Colorado. Note black remnants of lava on the bank of the river

⮜ **Ranger Riffey** contemplates the foaming Colorado as it boils over the last remnant of the barricade of lava it removed

⮞ **The Colorado River** at the base of Toroweap Lava Cascade, showing the great blocks of lava that remain to remind the visitor of a volcanic cataclysm that challenged the river for a time activity. The lavas of the inner canyon at the foot of Toroweap Valley have been subdivided into Lower, Middle, and Upper Canyon groups. It is the Middle Canyon lavas that filled ancestral Toroweap Canyon, while the Lower Canyon group dammed the mouth of Toroweap Valley. The bottom two units of the Lower Canyon group are described as single, massive flows; the upper two units are made up of layers of thin flows. The Middle and Upper Canyon lavas poured over the older lavas as one layer of chocolate frosting might be superimposed upon another. Both flows are thick and composed of dense olivine basalt.

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[1] See "Thundering Waters," by Philip Ferry in Natural History for June, 1949.

[2] See "Canyon Utopia," by Philip Ferry in Natural History for February, 1950, and "The Home of the Blue-Green Water People," by Josef Muench, April, 1940.

The over-all descent of Toroweap Cascade is 3000 feet. This figure is misleading when compared with the regular trails into the canyon, which are from seven to eighteen miles in length. The figure takes on significance when it is pointed out that virtually all of this drop is made down a massive chute choked with detritus, where one is either slipping, sliding, sitting on one's haunches, leaping from boulder to boulder, dropping down six-foot ledges, or performing other desperate gymnastics. The descent is one of the most trying performances one could wish to undertake in the name of pleasure.

There is no trail. The descent is down a natural drainage channel, which is choked with cinders, ash, and huge blocks of basalt. The footing is insecure in the extreme, and the descent is a wild scramble from which even the most agile emerge considerably bruised. Frankly, the trip is not one to be recommended indiscriminately. It is a rough-and-tumble escapade, where human shins wage an unequal contest against an unyielding mass of volcanic detritus that has withstood the ravages of centuries.

There is never a break in the exhausting progress. The upper portion of the lava flow is quite broad, but the black mass narrows toward the bottom until the concluding few hundred feet are made through a break created by a deep volcanic fault. The final drop to the river is down a long chute, where the chief worry is the ever-present danger of suffering a twisted ankle, a wrenched knee, or a broken bone. Such a mishap would have necessitated abandonment of the objective and the transporting of a cripple in a most difficult situation. Yet because of the insecure footing, avoidance of such a calamity appeared to be sheer good fortune. Those below must be on the alert against falling rock and rubble dislodged by those above. Handholds are few, the scattered shrubbery is easily pulled out of its shallow base, and the prevalent barrel cactus and opuntia would, of course, offer security only to a desperate person.

The climax of the scuffle is reached at the bottom of the cascade. Here is Lava Falls rapids, a roaring, plunging cataract. "Rivermen" consider it to be one of the three most dangerous rapids in the whole Colorado. This is the spot where the 600-foot lava dike once dammed the river, and remnants of the dam are visible to this day on the canyon walls above.

Our group of three – Schmitz, Ranger Riffey, and I–made the descent from the rim to the river in two hours. The return trip required three. This is good enough time considering the hazards involved and the heat of a desert sun. But Riffey reports that geology students from a near-by college, familiar with the route and imbued with youth's reckless indifference to danger, claim to run and slide down the long chute in something like an hour.

The return trip up the precipitous slope, at a time when we were already fatigued by the descent, was wearying beyond words. The climb in a hot afternoon sun can be murderously exhausting, and it is likely that every person who has ever made the round trip has asked himself why he was ever rash enough to succumb to the lure of the stunt. A plentiful supply of drinking water is a vital necessity. We had taken the precaution of caching two large canteens at intervals on the descent and as a result were well supplied on the long pull back.

Toroweap Valley is some 4500 feet above sea level. Remote though the valley has always been, it was one of the earliest explored in Arizona and Utah. The Spanish padre Silvestre Velez de Escalante and his Franciscan brother Father Dominguez crossed the valley in 1776. The padres had set out from Santa Fe to find an overland route to Monterey, California, an undertaking that failed.

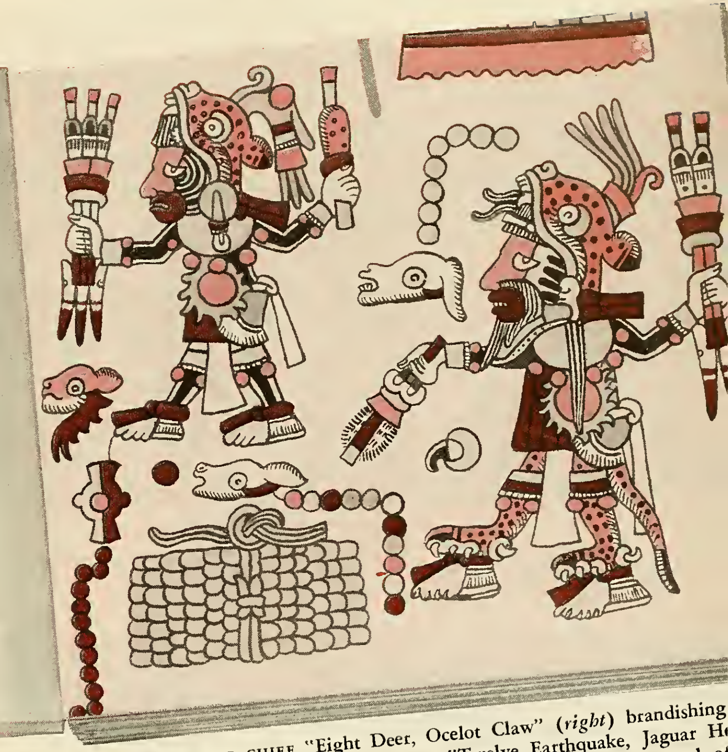
Generations of hardy homesteaders have run cattle in the long valley, although the scant rainfall is a regularly recurring threat that may make it necessary during a prolonged drought to shuttle the beef stock from range to range in search of feed. Since this involves rounding up the cattle and transporting them by motor truck, the expedient is not only a difficult one but expensive as well. When we visited the valley last May, the ranchers complained that they were enduring their ninth successive dry year. The drought was so general in northern Arizona that the state found it necessary to evacuate the buffalo herd from its regular range in Houserock Valley, 100 miles north of Toroweap.

To those seeking solitude, Toroweap Valley offers a perfect retreat. So remote was the valley in years gone by that it provided a refuge for polygamous Mormons and formed a hideout for cattle thieves and assorted renegades. The notorious Butch Cassidy gang frequented the valley, Cassidy himself having been reared in near-by Kanab. To this day, the law would have a difficult time flushing out a fugitive familiar with the topography of the country.

There is something unreal about the Toroweap country. Empty and isolated as it is, with its inescapable evidences of volcanism, including the hundred or more craters that rim the valley, and the dikes and lava flows that stand out so prominently, it has the appearance of an imperfect cosmic body still in the process of being formed. It seems part of the unfinished past, and Man appears an intruder. Or perhaps it belongs to a future whose final chapter of violent creation has yet to be written.

Within these vigorous documents lies a fabulous saga of magic, adventure, and romance—the life of early Mexico

The Picture Books of Ancient Mexico



▲ THE GREAT WAR CHIEF "Eight Deer, Ocelot Claw" (*right*) brandishing weapons as he marches with his brother, "Twelve Earthquake, Jaguar H (*left*). Minor differences in face paint and ear ornaments indicate the rank of two chieftains. (Mixtec Indian, Codex Nuttall)

BY
C. A. BURLAND

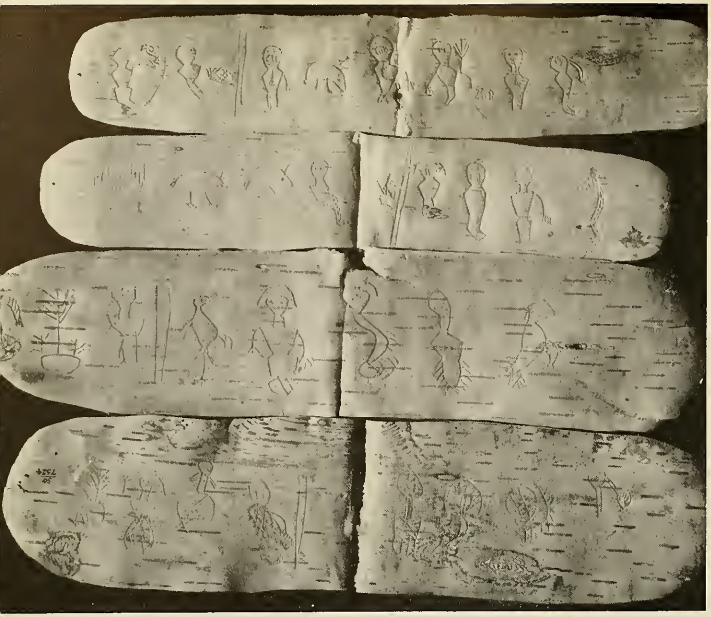
Honorary Curator, Abbey Art Centre Museum, New Barnet, Herts, England

IF you are one of those people who believe that history is a spiral and that space is expanding, I will forgive you if you fail to be surprised when you meet a Mexican Codex. I shall, however, hardly regard you as human if you fail to show a quite definite emotional reaction. Most people fall in love with the painted books at first sight. They are so colorful, so vigorously alive, so well designed. A full-color television program from the Disney Studios is the closest comparison in modern life that I can imagine. They are of too high a standard for the comic-strip technique, and, in any case, they need a spoken commentary. They were designed for just that purpose. In fact, these painted documents belong to an educational system that truly foreshadowed many of the most practical ideas in visual education today.

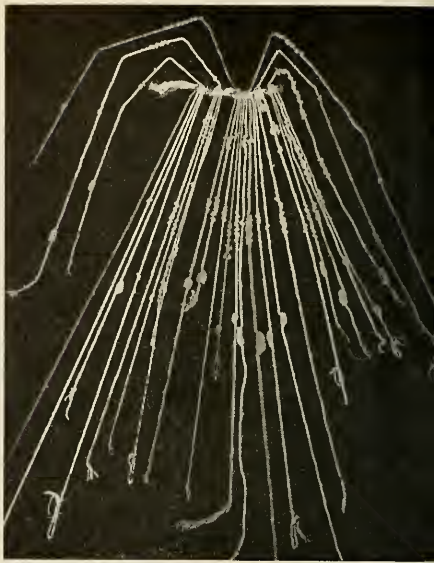
It all started in the Stone Age. As soon as human beings separated from their tribe, they found themselves seeking some way to leave messages. The world around held fruitful inspiration—a broken twig, a blaze on a tree, even a picture of an animal; these were the beginnings of all our ways of sending thoughts across the barriers of time and space to other human beings.

The American Continent, once mankind had spread that far, became an enormous field laboratory in which men could try out all kinds of ideas, uninfluenced by their relatives in the Old World. That is why we anthropologists are so interested in what American Indians have been doing in the last 20,000 years or so. Among their most interesting inventions were a variety of recording devices from wampum and quipu (knotted strings) to the Maya hieroglyphs and the forms of writing described in this article.

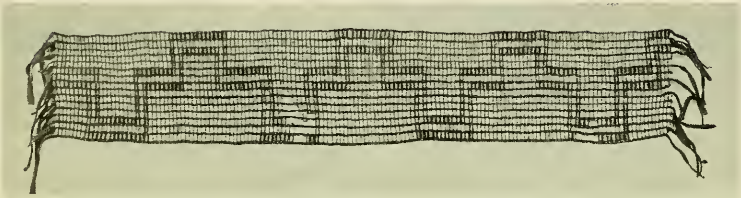
I suppose the simplest social background in which picture writing developed to any great extent was that of the Ojibway Indians, whose wise men were members of the Midewiwin Society, a secret religious organization. The chants recited and the visions seen by these people were recorded on scrolls of birchbark. They were quite simple series of drawings in linear progression, intended to remind the chanter of the events that his words described. Manitous, humans, animals, and profile sketches of places all added up to an associative sys-



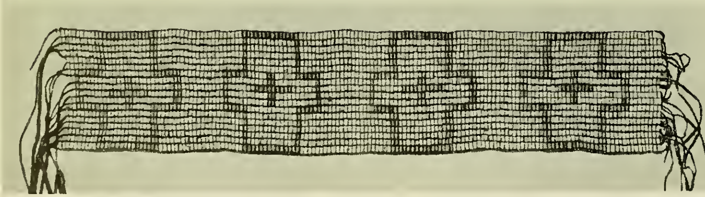
▲ Records of the Ojibway Indians of Minnesota. These simple pictures scratched on birch bark were understood by men who had been initiated into the meaning of each symbol. They were intended to refresh the memory. Most Indians had some such system of records



▲ Knotted strings known as "quipus" were used by the ancient Peruvians as memory aids. Otherwise the Peruvians scarcely used even simple pictography



The Penn Wampum belts: bead "documents" signifying the transfer of land. The upper belt is the "Freedom Belt" and signifies the right of the Iroquois to traverse the land in pursuit of whatever they needed



tem which guided memory and kept the narrator closely to his text. The double linkage was such that memory was incomplete without both elements—sound and picture. This often led to complications. If a group of pictures were lost, it was assumed that the story was no longer in existence, and reconstructions were not always made. In this context we have the extraordinary case of the Miami whose bird-bone "wampum" was lost in a fire and who, as a consequence, had no history!

It is when we come to deal with the Indians of the Southwest that we meet with a higher level of recording. It is often associated with a very ancient religious system, accepted in one form or another by the Indians from the Diaguite of Argentina, throughout the Andes and Central America as far as the Mississippi. The essentials of this cult were ideas of emergence from four previous worlds, of a universal flood, of water and thunder serpents, sun eagle, earth jaguar or puma, the Old Man Trickster (coyote), the four colors of the Maize, and Protective Power in the Rainbow. Because of the strange unity of belief in this tremendous region, it is often possible to "read" Indian works of art in spite of the wide diversity of social customs and languages.

This is precisely how we are placed with regard to the painted books of Mexico. They are the products of widely diverse tribes and yet have so much in common that it is possible to decipher a document and still have only the vaguest idea as to which tribe originally painted it. In fact, the similarities of style in the surviving Mexican codices are so overwhelmingly greater than the differences that it took centuries for the few scholars who ever studied them at all to realize that they were not all Aztec.

It is now time to describe them. They are usually strips of finely tanned skin, from seven to twelve inches wide, folded into nearly square pages. They close up rather like a map. Some were written on a coarse paper made from the inner bark of the *amaquauitl* or paper tree. These were painted upon direct, with some remarkable ink which did not run, even though the *amatl* was as absorbent as blotting paper. The skin documents, however, were more carefully prepared. First a layer of white paint was applied and smoothed down. (It seems to have been an oil-bound lime preparation, which dried with a glossy surface.) Upon this the artist drew his pictures according to a strict code of proportion. Some of the documents, including the Codex Nuttall in the British Museum, show where the artist has made corrections by painting over his errors with white and redrawing the picture. Yet in others, such as the truly amazing little Codex Laud in Oxford, the perfection of the drawing seems to have been attained at the first attempt: a wonderful achievement of craftsmanship.

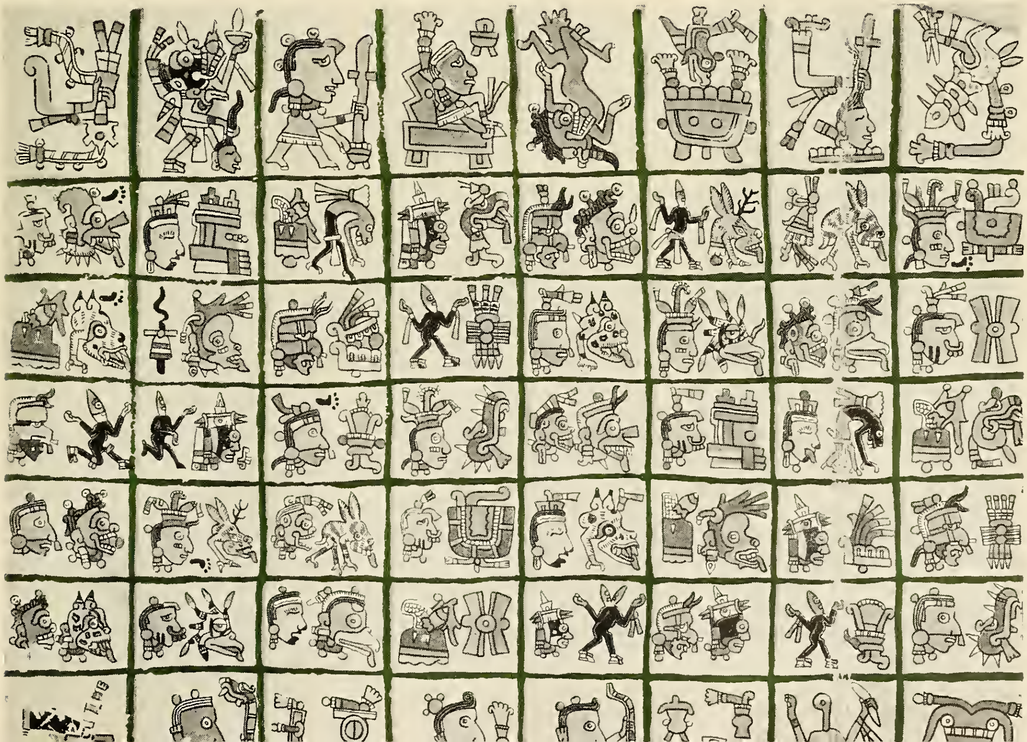
Now, what were the subjects depicted by the artist? History, religion, and statistics. Of the remaining pre-Conquest codices (excluding the three of Maya origin), one is statistical (The Tribute Roll of Montezuma), seven are historical (Vindobonensis, Nuttall, Bodley, Selden, Colombino, Waecker-Götter, and Boturini), and eight are religious (Borgia, Vaticanus 3773, Laud, Fejervary-Mayer, Cospiano, Borbonicus, Aubin, and the Selden Roll).

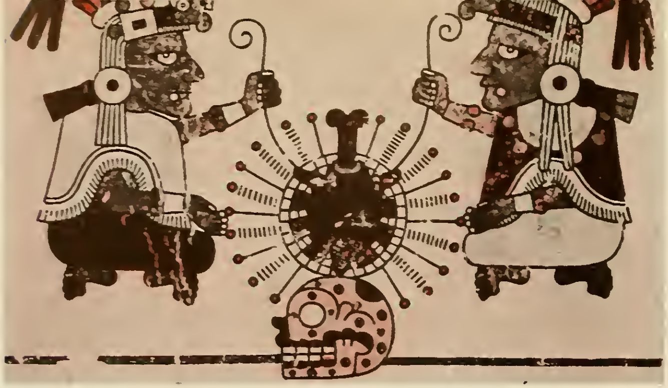
Although we can "read" these codices, we have small knowledge of their literary value. It is rather as if we had a movie drama without its sound track. We know the subject and the names of the people concerned, but each of us must recount the story in his own words. Of the sound of the hymns enshrined in the religious books, we have only the few words recorded by de Sahagún. Of the histories, such writers as Ixtlilxochitl, Tezozomoc, and Camargo convey the sense as understood by the Indians, but it is unlikely that their Spanish is a direct translation of the words of the history as memorized by the Indian record keepers.

It is certain that rhythmic, poetic forms of speech were used in repeating the stories painted in the books; but the religious works were often a kind of mathematical table for recording fortune and misfortune. They were tools of the trade for various priests and prognosticators, whose business it was to give assurance and peace of mind to the superstitious populace. There is no reason for us to think that the Mexicans regarded their magic books as having power in themselves. They saw these repetitions of days and numbers, of gods and offerings, as the statement of a philosophy.

Most of the works are expressions of a kind of "rhythm of the universe" approach to reality, but occasionally something different appears. A little picture in Fejervary-Mayer represents the Supreme Be-

▼ Part of a fortune-teller's equipment: a page from the Books of Fate, in Codex Cospiano. Here and there a black footprint marks a day specially favorable for childbirth





▲ A MEXICAN CONCEPTION of the supreme being. This double diety was mentioned by early missionaries but has no name. It was both male and female. The diety holds the spirit, fluttering like a butterfly, above a skull. (From Codex Fejervary-Mayer)

ing, The Unnamed, The Old Old Ones, The Two, as the Giver of Life. In the terrifying pages of Codex Borgia, now safely in the Vatican Library, we can read of the birth of the gods from a stone knife, expressed as a dualistic belief based on the movements of the planet Venus. Morning Star, Quetzalcoatl, the Precious Twin is opposed eternally by Evening Star, Xolotl, the Beastlike.

In places, even the beautiful Codex Laud has shocking revelations of the extent to which witchcraft entered into the religious system of old Mexico. One has only to study the pictures of Tlazolteotl, the Witch-Goddess, to realize that. In fact, the study of the surviving religious books makes one feel that it was a good thing for the honor of Mexico that Archbishop Zumarraga had most of them burned. It is as if an earlier and purer belief (not unlike that of the Navajo Indians) with a strongly marked dualism had been overlaid with several other beliefs, too many of which had a queer psychological twist toward destruction and filth. The sex side of these cults is marked in the books clearly enough, but it more often seems a rather childish perversion than the joyful letting off of steam which characterizes the more normal nature cults.

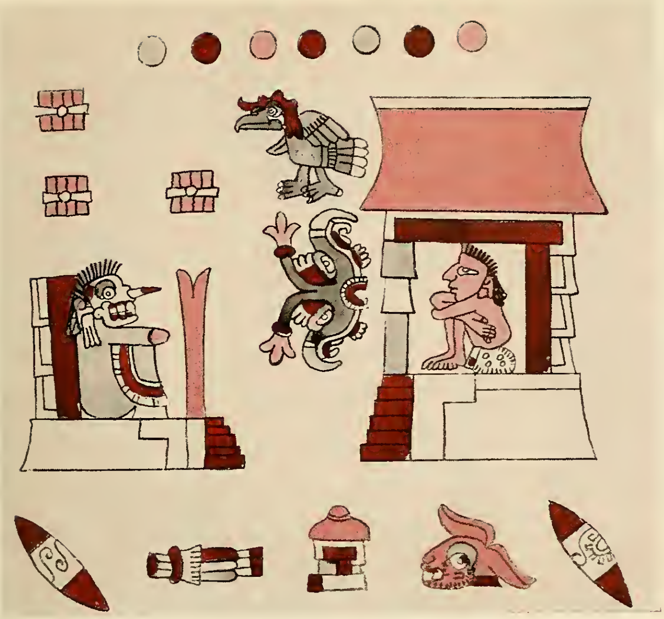
With the history books it is different. We enter a world where a normal human can feel at home. There is the straightforward simplicity of Codex Boturini to bear witness to the qualities of organization that the Aztecs possessed in such good measure. Glyphs, place names, people, and their personal names all follow a direct sequence through time. Even to those of us who have no clue to Mexican glyph reading there is evidence of purpose and sequence that would naturally lead to an understanding of Mexican writing systems. The subject of Boturini is the migrations of the Aztecs, first from Aztlan with the other Nahuatl-speaking tribes to the place of Seven Dwellings, the Chicomoztoc, and thence alone to the Valley of Mexico. The story breaks off with their arrival and the Battle of the Ears, which is the last event recorded about the Mexicans while they were subject to the chiefs of Colhuacan.

Among the Mixtec histories we find ourselves to be in a country as exciting and unpredictable as the Mixtecs' own mountain homeland among the cloud-capped peaks of Oaxaca. Much of our difficulty with this, the largest group of codices dealing with one subject, has been the aristocratic tradition of the Mixtecs themselves. They were an ancient people and had formed a very important section of the Toltec confederation — whatever political form that still mysterious culture may have taken. They date their histories from the bringing in of the Toltec cult of Quetzalcoatl and the arrival of his symbols, including a medicine bundle and the Staff of the Morning Star, to the local temple. Each chiefly family kept its own genealogy with the most exclusive care, but it is rare that any were willing to admit the possibility of being a junior branch. Therefore, there are all manner of disjointed genealogies in the larger codices, which need a great deal of research to bring them into a general historical scheme.

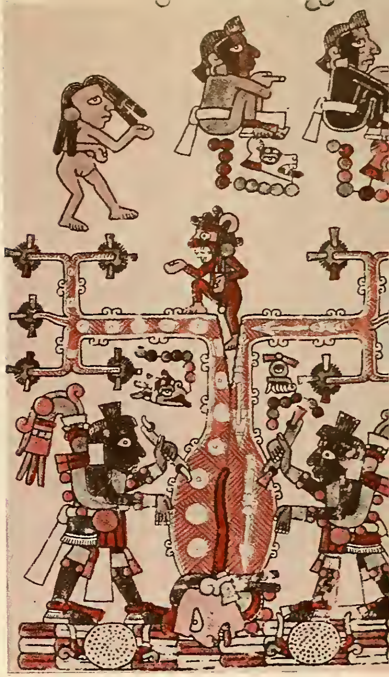
However, two of the Mixtec codices deal with a far longer period than that which followed the fall of Tula in the tenth century. Vindobonensis, of which a fine facsimile edition was made in 1928, and the Codex Selden (only inadequately reproduced by Lord Kingsborough in 1831) purport to begin with the creation and continue to the birth of the Mixtec nation and the descent of Quetzalcoatl. These documents must have formed the basis of a tremendous chant, one of those epic paeans that linked the chiefly family and the people in a common emotion of pride in the glorious achievements of their race.

The lesser works, including the strangely irregular Codex Nuttall, still retain their charm, but they tell stories more akin to Red Indian romance and adventure. They give a great deal of space to the national hero, Ocelot's Claw, surnamed Eight Deer, who extended their power to its widest limit, even to Tehuantepec, in southernmost Mexico. The Mexican calendar system was based on cycles of 52 years. The peculiar fact that Eight Deer died as a human sacrifice exactly on the completion of his fifty-second birthday—an exact calendar-round —made it only too easy for many early students to assume that he was a calendrical myth. It was not until 1912 that Major James Cooper Clark was able to show that Eight Deer was a real person.

The "Eight Deer" group of codices were long suspected to be of Mixtec origin, but proof of their tribal origin had to await the discovery that the genealogical records of the Codex Waecker-Götter were annotated in a Spanish hand but in the Mixtec language. This was further clinched by Dr. Alfonso



▲ In the technique of recording and conveying messages, the peoples of Mexico made great strides over other groups in the Western Hemisphere. Here we see one of eight pictures covering 360 days and representing various aspects of the death god. (From the Codex Laud, Kingsborough edition)



▲ The birth of a nation. From a tree repr sented as a goddess, two minor godlin (Seven Eagle and Seven Rain) carve a dru (Codex Vindobonensis)

Caso's discovery that the post-Conquest map of Teozacoalco recorded land claims of Mixtec notables. They proved their case by reference to genealogical tables which included the great Ocelot Claw (Eight Deer) in person and many of the other figures well known in the historical codices. From this followed many other discoveries, which are being published by Dr. Caso and which I do not intend to discuss here. Thus it may indeed sound as if we had solved most of the problems of the Mexican picture writing. As a matter of fact, the more we know, the more problems confront us. There are still many symbols that cannot be read. There are the social systems of the Mixtecs to be explored and the legends to be discovered that gave rise to some of the more surprising pictures in the religious books. Or did the legends really only form a popular rationalization of a priestly philosophy, of which we now have only the vaguest notions?

Then there are questions of beginnings: When and where did these systems of writing and calendrical record originate?

Finally comes the problem that fascinates me most. What is written on the hidden document beneath Codex Selden? Only in July, 1950, did Dr. Caso visit England and discover that this document was a palimpsest—a record on top of a record. He asked me to follow up his discovery, and there is no doubt whatever that underneath the white verso side of the Codex are the vestiges of a more ancient painting. It is possible to see one or two parts of figures, the flame of a torch, parts of date symbols, etc. There, hidden at the moment, lies an ancient Mixtec painting that has not been seen for nearly five centuries. Shall we glean any new facts? Who knows? If the chemical experts and photographers can produce a picture, even a hazy one, then we shall be able to say with certainty what the subject is.

There! We have traveled from a general viewpoint to the particular—from the transfer of thought by signs and symbols to one single precious document in the Bodleian Library at Oxford. We have become specialists! That will do no harm if we are also willing to spend time on the general problem of how mankind learns to transmit his thoughts, and then apply our hard-won knowledge to the practical work of education for a future, a more civilized way of life.

Meanwhile it is very pleasant to spend an occasional evening at leisure poring over the painted books of ancient Mexico. If any of my readers should own one, pray lend it to me or send me photographs for which I cannot pay. But if you are a millionaire, there is room to help other students to learn these matters. The Mexican documents still only available in the inaccurate Kingsborough edition of 1831 should be properly reproduced in facsimile. There is valuable work to be done, if we are given time, in making these things available to science throughout the world.

▲ Great Gull Island, within sight of civilization but completely isolated by the absence of all communications. Plum Island slumbers in the background

AN Island Venture

The experiences of two Miss Robinson Crusoes who spent a month for science on an uninhabited isle

By Lois J. Hussey and Catherine M. Pessino

Photographs by the authors

To most, a deserted island means a sandy atoll, swaying palms, a tropic moon, and leisure. For us it was an island just three and a half hours by train and boat from New York City, treeless, foggy, with summer storms and work. There we were to spend 28 days alone, within sight of civilization yet removed, without radio, telephone, or boat.

"Our" island, as we now think of it, is Great Gull Island, eight miles east-by-north of Orient Point, Long Island. The American Museum of Natural History received title to this island in 1949. For many years it had been the property of the United States Government, which purchased it in 1803 and allowed the lighthouse personnel on neighboring Little Gull Island to use it as a garden.

The Keeper's journal for 1833 reveals that a team of oxen was bought by the keeper, Mr. Chase, and kept on Great Gull during the summer for plowing and hauling. However, the island's large population of meadow mice made gardening unprofitable. During droughts, when the cistern at the lighthouse was empty, water was hauled from the well on the larger island. Driftwood, collected along the shore, was an important source of fuel at the lighthouse whenever stormy weather delayed the arrival of a packet sloop laden with cordwood.

In 1897, the Government began the erection of Fort Michie, and until after World War II it was part of our East Coast defense guarding the approaches to Long Island Sound. Improvement in defense techniques rendered it obsolete for this purpose, and now it is to be developed as a bird sanctuary.

During the early years, Great Gull Island was famous for the large number of terns that nested there. In the last half of the nineteenth century, these birds were ruthlessly slaughtered for the millinery trade—so much so that they all but disappeared from the Atlantic coast. Boatloads of gunners greeted the birds returning south from their winter homes; eggers persistently robbed the nests; fishermen, too, accounted for many. One season 40,000 skins were taken from a single colony.

In the summer of 1889, a Museum expedition under the direction of Dr. Frank M. Chapman was sent to Great Gull Island to study the colony of terns. At that time Great Gull Island, and Muskeget and Penikese Islands off the coast of Massachusetts, had the only large colonies left from New York to Maine. They managed to survive only because the islands were uninhabited and relatively inaccessible. To protect the colony the Linnaean Society, the West Side Natural History Society, and the American Society for the Prevention of Cruelty to Animals, all of New York City, joined forces to pay for the appointment of the lighthouse keeper as State Game Protector. In 1896, he reported 7000 pairs of nesting terns on Great Gull.

The very next year saw the beginning of Fort Michie. Buildings and matériel covered most of the island, leaving room for only 2000 terns. Not a single egg was allowed to hatch that year. Most were eaten by workers who were not provided with meals by the construction company. As many as a dozen per day were eaten by an individual. The remaining eggs were blown empty and the shells carried off as souvenirs.

With the more intensive protection accorded the terns since 1900, a few colonies have once more been established on the southern and eastern shores of Long Island. Today, the rapid development of summer resorts in this region again

▲ **Catherine Pessino standing** in a tall growth of chicory and melitot, the two most abundant plants on the island. Decoys were planted among these growths in an attempt to lure the terns back to Great Gull

▲ "**Home**" was a four-story observation tower, remnant of abandoned Fort Michie. The Army had stripped the building of all conveniences, leaving behind only the busy house mice

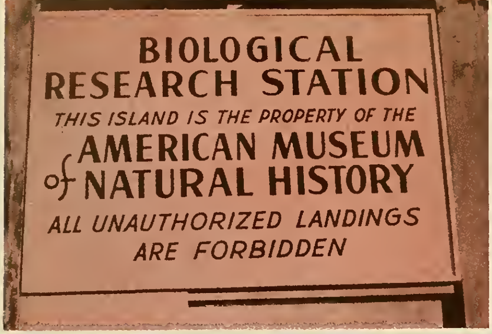
▼ **Coast Guardsmen** departing on the patrol boat "Noel," leaving the authors on Great Gull in complete isolation

jeopardizes the existence of these birds. The number of Common Terns and Roseate Terns in the colonies around the Orient Peninsula has decreased in the last few years. The need for a new, protected site in that general area is acute.

Now that the American Museum of Natural History has title, a joint committee from the Museum and the Linnaean Society has been formed to develop the island primarily as a nesting site for terns.

Our purpose in going, aside from a desire to organize and successfully carry out such a venture, was to find any evidence of nesting terns; to determine, if possible, the probability of the return of a colony; to gather facts as to the number of trespassers and any other information that might assist the committee in deciding upon a future course of action.

Transportation to and from the island proved to be something of a problem. We could either charter a boat or engage some friend of the Museum. We knew that our only neighbors would be the United States Coast Guard at Little Gull Light Station, a half mile to the east. Since we would be alone, without telephone or boat, our friends thought it best if the Coast Guard knew of our proposed stay on the island. We learned that the personnel made frequent trips to New London, Connecticut, for mail and supplies, so we asked if we could be put ashore at Great Gull on one of



▲ A STERN WARNING from the American Museum, which is undertaking to develop the island as a nesting site for terns. Trespassers can inadvertently disturb a colony enough to cause the birds to leave

➤ IRON RUNGS set in the concrete walls of the tower led up through hatchways to the floors above. The forced exercise was good for the waistline but hard on the hands

▼ MISS PESSINO prepares a meal on a Coleman stove. The two five-gallon jugs contained the only fresh water on the island and were used only for drinking

those trips. Permission was kindly granted, orders obtained from the Commander, 3rd Coast Guard District, and we were off, not as expected in an open 20-footer but on an 83-foot patrol boat. Actually, by the time our supplies were assembled on the dock—supplies that had been begged, borrowed, and appropriated from among the Museum's storehouse of equipment – we felt that 83 feet were none too many. Sleeping bags, rope, pail, sun-tan lotion, plant press, sulpha powder, hammer, nails, labels, gasoline, ponchos, mouse bait, and alarm clock were but a part of the provisions carried aboard.

We saw the island for the first time through binoculars. The word "deserted" had been thrown at us so often by people who had tried to dissuade us that we were astonished to see towers, buildings, and gun emplacements silhouetted against the gray sky. We had seen photographs; but, somehow, to see it all there before us was as surprising as it was exciting. The men aboard the "Noel" wondered why we had not chosen to vacation in Bermuda, Cuba, or Atlantic City. Why had we picked this unmanned spot? They regaled us with stories of "poisonous snakes," "mosquitoes so large that one holds you by the arms while another sucks blood," nor'easters that send waves piling overhead, fog, shipwrecked sailors, and more.

After tying up to the 250-foot dock, which had been constructed by the army on the north side, the crew helped us carry our supplies into the nearest building. As the old well was no longer in existence and no fresh water was available, special care was taken with two five-gallon jars, our entire supply. The army had given up its search for a large supply of fresh water after drilling to a depth of 1800 feet and had constructed a storage tank with a 172,000-gallon capacity to hold water carried in by tank ships. Our two five-gallon jars were to be used solely for drinking. Dirty faces would not matter.

A dense fog had rolled in shortly after we docked, so the "Noel," upon departing, was lost to sight immediately, making our isolation more pronounced.

The first task was to decide where to live. There was no housing shortage provided one was not particular about absent windows, warped doors (or none), dampness, debris, no water, electricity, or other conveniences. We decided to use a four-story concrete observation tower, the only place where the island could be viewed in all directions. The ground floor was left vacant. Its roof, which extends out from the first floor, was used as a porch or sun deck. The first floor became a kitchen and, with buckets of salt water, a washroom. Unlike the upper floors, there were no windows to let in the sun. This made it an ideal storage place for our food and fresh water, very like the cold cellar of a farmhouse. The second floor was used as living quarters, the top for sleeping. Iron rungs set in the concrete walls led up through hatchways to the floors above. Invariably, the one item we reached for was on another deck. The forced exercise was good for the waistline but rough on the hands. We scrounged shelves and racks from other buildings, put up cots, made a bench and tables, tacked cheesecloth and newspapers over the empty window frames to keep out insects and dampness, and were soon shipshape.

Before accomplishing all that, we undertook a more intensive exploration. Tons of granite from the New York City subway excavations have been dumped around the island to prevent the shore line from washing away. Much of the surface is covered by hard-top roads and railroad tracks. The cattail swamp, once the habitat of the meadow mouse and toad, is gone. What dirt once covered the island is now part of breastworks for the gun emplacements. The island is honeycombed with tunnels. By flashlight we searched the underground reaches, finding nothing but dampness and tumbleweeds. It was difficult to imagine the place with electric lights, shouts, commands, the rumble of overhead conveyors, the bustle of repair shops, and all the other activities of a garrison of 400 men. It was easier to imagine the island as it once was when just terns, gulls, meadow mice, toads, and other creatures ruled.

When an army moves out, everything of any intrinsic value, and more, goes. Even the light switches had been stripped from the walls. The only things left, excepting the concrete, brick, and corrugated buildings and the dock, were house mice. They could find nothing in the buildings, and by the time we arrived they were established in the grassy places, fat with insects and seeds, digging shallow burrows for protection. The house mouse, brought to the island by man, has supplanted the extinct Great Gull Island Meadow Mouse, *Microtus nesophilus*, which had ruined the lighthouse keepers' gardens. The first trap we set yielded one sore thumb. Even though we realized the improbability of finding one of the meadow mice, each time a trap was sprung hopes ran high—the same type of wishful thinking that in years past caused people to search Great Gull for pirate's treasure.

On the fourth day we received our first mail. The arrival of the postman, one of the men from Little Gull, was announced by a family of Spotted Sandpipers near the dock. The adults, worrying about the safety of their young, never failed to call out in alarm when anyone appeared. After that a Coast Guardsman, en route to the mainland, stopped once or twice a week to see if we needed any supplies and to check on our welfare. All this attention was unexpected and very welcome. We arranged a system of signals with the Chief at the light station: long red underwear hung from the top of the tower by day or red flares by night were to serve as an SOS. Fortunately, the occasion never arose when it became necessary to signal for help.

The preparation of meals was a simple matter, as we both knew how to use a can opener. The week before departure we had walked up to the checkout counter of a local A & P with $35.96 worth of canned foods (four baskets of small items). We did our cooking on a Coleman stove. Cans were opened in rapid succession, the contents tossed unceremoniously into pans, and all was ready for serving in a few minutes. The owner of the gasoline stove, a veteran camper, had boasted of his cornbread made over the open flame. Not to be outdone, our specialty was shortcake, buttered and topped with raspberries, both from cans. Weather permitting, meals were eaten on the sun deck. Our only actual purchase, other than food, had been two folding aluminum chairs. These, drawn up to an improvised table — drawer plus board—made a comfortable setting. Between bites it was possible to watch life around us.

Our noisiest inhabitants were a family of killdeers, *Oxyechus vociferus*—"vociferus" indeed! They, in addition to song sparrows, red-winged blackbirds, and spotted sandpipers, made up the nesting population. It was possible, by determining their territories, to discover the number of breeding birds. By the time we arrived, June 25, all the young had left the nests (but not the island), except for a family of redwings. Several hours of patient observation revealed the young of all but the killdeers, who managed to lose themselves in the tangle of weeds. We had given up all hope of seeing

▲ Looking toward Little Gull Island, a half mile east. In 1803, lighthouse personnel there were permitted to use Great Gull as a garden, but meadow mice made the venture unprofitable

them, when one stormy day we happened to look out a window to see one of the adults walking along the road with the young—four balls of fluff, comical in appearance and antics, scurrying along on stilts, stopping now and again to tug at some food.

We observed 37 species of birds during our stay. Some, like the bank swallows, black-crowned night herons, cormorants, gulls, and terns, were daily visitors. Occasionally a yellow warbler, brown thrasher, phoebe, robin, or redstart would spend a few hours or a night. Other months the number of species would surely increase considerably, for Great Gull is on a well-traveled migratory route. When we left, July 22, flocks of dowitchers were already flying over the island on their southward migration. One day we had an unexpected caller, a pigeon, far from the sociability of city pavements. He spent a solitary hour walking on the roof tops. We later learned that our visitor was Elmer, our neighbor's pet. Elmer had been fed on his first visit to the lighthouse and had remained ever since.

Since the terns were our main concern, it had been disappointing the first day to find that none were nesting on the island. Still, they acted as if the island was their own, constantly molesting other birds that fished in the area. On most of their fishing expeditions to the island, the terns discovered the one or two ospreys. When this happened, a great alarm went up. An angry, screaming mob of perhaps a hundred or so terns took to the air. All was wild excitement. Each darted down at the interloper who had invaded their fishing grounds. Through it all the osprey remained indifferent, departing only when a fish had been caught. Undoubtedly there were young ospreys on a nest waiting for dinner to arrive. The terns, shouting their annoyance, continued the chase till the osprey passed beyond the island. "Unbidden guests are often welcomest when they are gone."

At other times the black-crowned night herons sitting on the dock would attract the attention of the terns. A few would be driven off, but the braver ones would remain, patiently ducking time and again as a tern swooped low. The terns soon tired of this and resumed feeding. Another bird not tolerated by the terns was a kingfisher. He, unhappy fellow, had but one recourse—to hide among the rocks and batteries.

Fishermen call the terns "mackerel gulls" and "bluefish gulls," for they indicate where the mackerel and blues are feeding. The terns feed on sand launces and other fish called spearing when the latter attempt to escape the larger fish below and swim to the surface. Thousands of launces were often seen milling about the pilings of the dock, trying to evade their enemies. To see flocks of 20, 50, or 200 terns feeding is an unforgettable sight. The contrast of black caps and gleaming white feathers, flashes of brightly-colored bills and feet, the seemingly effortless and marvelously graceful flight produce a never-to-be-forgotten picture. They fly over the water with heads bent, pause, hover for an instant, then plunge headfirst into the water. A moment later they reappear with a launce dangling from their bills, then vigorously shake the salt water from their feathers, and fly on in search of the next catch.

Plum Gut, the waters around Great Gull Island, and the Race are famous fishing grounds for striped and sea bass, as well as mackerel and bluefish. Near the dock a man caught 21 mackerel in less than an hour! Weekends and holidays, private and chartered fishing boats surrounded the island. Most were incurious or unaware of our presence. For them it was still a deserted island. The few parties that did come ashore turned back when we pointed out that the island was a sanctuary. All were most co-operative.

The threat of "shipwrecked sailors," mentioned by the crew of the "Noel," was fulfilled! We were finishing supper on the Fourth of July when we heard voices down by the shore. Upon investigating, we found two men, waist-high in the cold water, fighting to keep their sailboat, a "Pow Wow," from being dashed on the rocks. Because of winds and a strong current, they were barely able to secure the boat. By the time they had changed into dry clothes, a hot meal was ready. They told how they had floundered off Plum Island and how the storm had almost carried them past Great Gull and out to sea. It was only after we had all enjoyed a cup of coffee and some apple pie (which they had bought that morning in New London) that they thought to wonder what we were doing on an otherwise deserted island. Later that evening it cleared enough to watch some of the fireworks at

Ocean Beach, across the Sound; the storm had passed, and our guests were able to repair their boat and resume their cruise.

We collected plants and insects. While pressing the first plant specimen, one of the clovers, *Trifolium repens,* we discovered that it was a four-leaf clover, the only one either of us had ever found. Luck was with us! On August 13, 1949, Dr. W. T. Helmuth had made a survey of the island. He found no poison ivy, a fact that pleased everyone concerned. But unfortunately, twelve months later, it had become abundant in a few places. Probably the army had held it in check while they occupied the island. With the discovery of the common burdock, a scream rent the air. Catherine, unwittingly, had sat on the only plant.

Hoping to lure the terns back to the island, the Committee had set out decoys in April in one of the two large areas that might again be suitable as nesting sites. By June the decoys were hidden by a dense growth of chicory and melilot, the two most abundant plants on the island. These plants were five and six feet high and harbored myriads of aphids, which were eaten by the redwings and song sparrows. Bumblebees, adult ant lions, wasps, drone flies, rose beetles, velvet ants, crickets, and ladybugs were but a few of the insects we collected by sweeping the plants with nets. The garbage pail yielded our largest specimen, a huge Green Caterpillar Hunter, *Calosoma scruator.*

▲ MISS HUSSEY enjoying a dinner of canned goods on an improvised table on the sun deck. Between bites, the girls could watch the wildlife around them

▼ COLLECTING ALGAE and invertebrates on the rocky shores. The main objective of the expedition was to gather information that might further the development of Great Gull Island as a bird sanctuary

It was easiest to collect some insects at night, for then they came to us. The gasoline lamp placed near an open window made the room an excellent trap. "Wanted" specimens were killed in a cyanide jar, "unwanteds" left alone. Some of the latter managed to find their way out, but many became entangled in the webs of the spiders that shared our tower.

Of the few chores that had to be done daily, dishwashing was the most enjoyable. We did dishes once a day, at sunset. The two forks,

◀ Miss Hussey relaxes after a day's exploration. The tower was the only point at which the island could be viewed in all directions

plates, spoons, a knife, and one or two pans were placed in a pail and carried down to the dock where they were washed in the salt water. Sometimes it took an hour to do the dishes, for it was pleasant indeed just to sit and watch the day end. All too soon the beacon at Little Gull was turned on. In fifteen minutes, night would officially arrive. One by one the lights on the Connecticut shore appeared. As if by signal, the terns that had been feeding about the island began to leave. At first, one or two slipped away unnoticed. Soon groups of three or more departed. Before long a steady stream was passing by, very likely wending their way back to Plum Island, Gardiner's Island, and other nesting sites.

Many mornings we awakened to hear the foghorn at Little Gull blasting away at thirteen-second intervals. The tendency was to turn over and sleep some more. We rather enjoyed the fog, for, though familiar sights were blanketed, familiar sounds were uncovered. It was easier to hear the bank swallows flying overhead, to hear the Orient Point ferry go by, to recognize the different fishing boats by the sound of the engines, to hear the constant clamor of terns feeding, the far-off "quonk" of a black-crowned night heron, the splash of a lobster pot being lowered into the water, and the put-put of the motor starting up once more. Four lobstermen had pots around the island. We soon learned to recognize the varicolored markers bobbing on the waves.

The twenty-eighth and final day came all too soon. That morning, on a last tour of the island, we saw a young Common Tern sitting on a rock off shore. Tottering, rough-feathered, he was ignored by all but his parents. For us he was our biggest find—a promise for the future. One of this year's young might be the first to choose Great Gull Island as a nesting site another year. One factor that may prevent these birds from again nesting on the island is the so-called "weeds" that overrun Great Gull. Bindweed, rose brier, and particularly Japanese honeysuckle have become well established in some areas and will spread rapidly. These plants must be checked to some extent, because Common Terns prefer open places. To attract Roseate Terns, a certain amount of vegetation is desirable. For them, the small amount of beach grass, *Ammophila,* that we found might well be encouraged. The first week approximately 100 Common

➤ Pegging lobsters. The waters around Great Gull are famous fishing grounds for striped and sea bass, mackerel, and bluefish; but sportsmen were unaware of the authors' presence on the deserted island

and Roseate Terns visited the island daily; the last few days the number had increased to 400, with the Common Terns far exceeding the Roseates.

Today the terns are protected by law. Never again should there be the ruthless slaughter that once netted but ten cents per bird. However, protection from guns and souvenir hunters is not enough to ensure the safety of a colony. When the terns are again established, as we hope they will be, on Great Gull Island, a warden will probably be necessary to protect the breeding birds from the unmindful trespasser who, inadvertently, can disturb a colony enough to cause the birds to leave.

Luckily, the last day was a "weather-permitting" day, clear and calm, for we made the return trip in an open 20-footer. Our equipment was packed and waiting at the dock for the boat to arrive from the light station. Included were the collection of insects and plants, together with our notes, to be brought back to the Museum for further study. We piled in on top of our supplies and with some regret cast off. The only visible signs that we had inhabited Great Gull were the squares of newspapers showing in the broken windows of the tower.

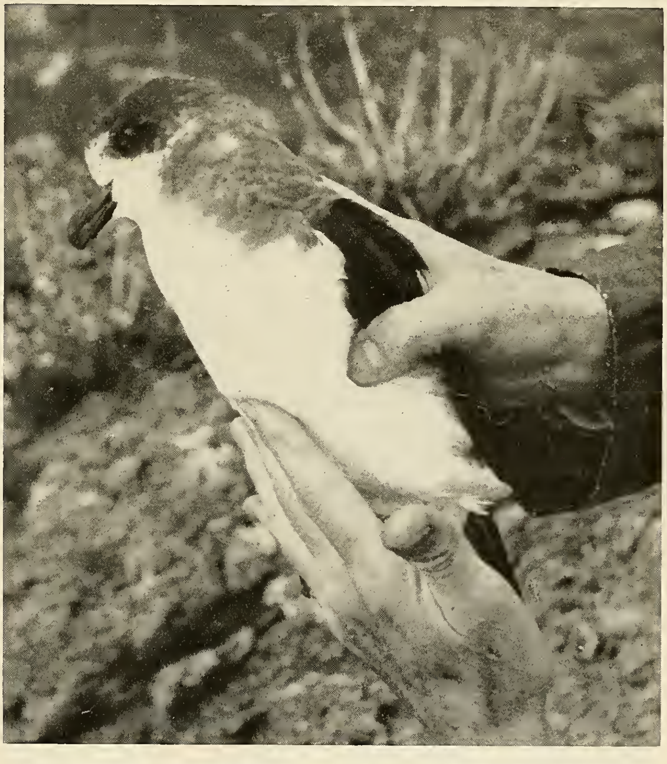
THE CAHOW STILL LIVES

Continued from page 156

pounded 30 feet below us, and now and then a swell would strike some undercut with a thud that made the whole island shake. No wonder that the soft, flaky limestone is falling to pieces! Then it began to rain, continuing at intervals all night, but fortunately, there was only one short period of heavy showers.

Cramped and weary, we remained at the first nest, except when one of us left briefly to exchange reports with Louis and David. Sometimes we dozed fitfully under a dripping poncho, until the sledge hammer of a wave would startle us awake. At frequent intervals we crawled to our burrow, turned torches down the tunnel, and watched the pair of cahows. The beam of light apparently created no disturbance. The birds could be seen nibbling each other's beaks and necks and then launching into an ecstatic turn-around in the small chamber, puffing up their plumage and shuffling about each other on bent legs. It was not possible to see whether one remained on the egg or whether the egg merely lay in the middle of the melee.

At 11:40 P.M., when the light was switched on the entrance of the burrow, one of the exquisite gray petrels was sitting quietly at the threshold as if ready to depart. The mates had thus remained together carrying on their connubial posturing and display for approximately three hours. As we prepared to make a flashlight photograph, the cahow at the door suddenly turned and retreated into the tunnel. Some time between then and midnight, however, it slipped away silently into the blackness. From then until morning no further activity was observed.



▲ A CAHOW just extracted from its burrow. The birds proved unexpectedly calm and gentle. When released, they returned promptly to the egg

A few days later we found a better way of inspecting a cahow's nest. We located a burrow eleven feet deep that ran under a massive limestone dome. By measuring with a fish pole, we found that the occupants and their egg were beyond the far side of the dome and that we could open the actual nest chamber with a prospector's pick. One bird retreated down the tunnel toward the entrance, but the other remained on the egg until we lifted it off, and unconcernedly resumed its task as soon as we had replaced it. The stone slabs were then shingled back so that the chamber became as dark as before and even more rainproof. It could be opened again with ease, however, and on March 2, after our return to New York, Louis Mowbray had the satisfaction of finding that the egg in this nest had hatched.

Louis, in his official capacity as Curator of the Museum and Aquarium, is adviser to the Government on many aspects of conservation. The Bermudian response to our findings was immediate and effective. Steps have already been taken to make sanctuaries of all the occupied islets and to give the cahows every other possible protection. The spacious nesting grounds of former times are, of course, permanently gone. The greatest present hazard to the cahow is the narrow margin of safety provided by its greatly reduced numbers, which are confined to small islets. The population is perhaps of the order of 100 adult birds. There may be fewer, but there are not likely to be more.

Unrelenting destruction of rats is a prime necessity. By spreading for a limited period baits poisoned with "Warfarin," the safe and complete elimination of rats would be feasible. If, in the meanwhile, the present nesting islets are kept secure, the larger insular stations, such as Castle and Nonsuch, may eventually become available for an overflow population of cahows from the smaller places. Under such circumstances the future of the beautiful and historic sea bird, which is a symbol of Bermuda alone, would be assured.

One of the questions invariably asked is, "How do you pronounce cahow?" Webster's Dictionary offers a choice—ca-HOO, CA-how—but we doubt its authority. After all, who has heard it from the mouth of any seventeenth-century Englishman who learned it, in turn, from the bird's mouth? Our cahows were unexpectedly silent. We can only interpret this as meaning that their garrulity dies away as incubation advances. Next November, when the mated pairs are full of song and courting and gusto, the birds themselves will surely tell us their rightful name.

LETTERS *Continued from page 146*

by T. Donald Carter of the American Museum's Department of Mammals:

Personally, I have had no experience with the effect of different chemicals on the porcupine, but I do know that wood dipped in or painted with creosote is distasteful to the animals and affords some protection. An aluminum-sulfate spray is used as a protection against rabbits and rodents, and this may also be effective. A preparation called Good-rite, Z. I. P., manufactured by the B. F. Goodrich Chemical Company, Cleveland 15, Ohio, is used with good effect to protect vegetation from deer, and it may work with porcupines as well.

Albinism in Robins

SIRS:

I have a specimen of a pure albino robin that has been stuffed by a taxidermist. Is albinism in robins very rare?

IOADELLE M. NOEL

Joliet, Ill.

Dr. Ernst Mayr of the American Museum's Bird Department comments as follows:

Albino robins are by no means a great rarity. We have several specimens in our collections, and reports of such birds are not infrequently recorded in the literature. Albinism occurs fairly regularly in some of our native birds, perhaps most commonly in the grackle, robin, and song sparrow. At least, these are the three species in which we see albinos most commonly. Perhaps this is only because they are common and occur near our homes.

Jumping Fox

SIRS:

About seven o'clock one morning this winter we looked out through the fog over the ice-covered snow in our back yard. We were startled to see a fox busily poking in and around the honeysuckle underbrush. Suddenly he started to run in circles, leaping high into the air over and over again.

Can you account for the actions of this animal? Do foxes catch insects when other foods are not available?

MRS. JULIUS R. SMAK

Fairfield, Conn.

The following remarks are offered by T. Donald Carter of the American Museum's Department of Mammals:

I would say that the fox was trying to locate a rabbit that was hiding in the honeysuckle. It is possible that the fox saw the rabbit enter, or he might have tracked the rabbit that far, or again he might have smelled or heard him. A fox will sometimes hunt a mouse in much the same way, but from the description I would say that the animal being hunted was of a larger size. A fox will often indulge in this form of hunting when his quarry is in grass so tall that he cannot see over it. He will also stand on his hind legs to look over the grass tops. Under similar circumstances, dogs will often jump in the same manner.

Foxes eat a great many insects, including grasshoppers and crickets. They are also fond of fruit.

Dwarf Domestic Fowl

SIRS:

In the October issue of NATURAL HISTORY Magazine, a question was raised by Mrs. J. C. Hageman, Lorain, Ohio, regarding the occurrence of dwarf individuals in birds. Although Dr. Zimmer has adequately answered the inquiry, I would like to add that dwarfism is known in the domestic fowl, and at least one dwarf breed is recognized, the Creeper.

The Creeper has shortened wings and legs comparable to the shortening of the limbs in mammalian dwarfs. As a result, the bird has a squat appearance and a peculiar gait. The trait is due to a dominant gene which is lethal to homozygous individuals, the eggs of such never reaching the hatching stage.

The common fowl, as well as other domestic breeds of birds, provide good hunting for those wishing to observe avian abnormalities. Under the more or less artificial environment in which they exist, many aberrant individuals survive, whereas in nature they would be swiftly eliminated.

ALBERT G. JOHNSON

Arnold Arboretum,
Jamaica Plain, Mass.

Indeed!

The Trumpeter Swan, once one of the rarest American birds, is now well on its way back to safety, in the opinion of U. S. Fish and Wildlife Service biologists. This conclusion is based on the fall census taken at breeding grounds in Yellowstone National Park and at Red Rocks Lakes National Wildlife Refuge in Montana. The count showed a population of 376 birds as compared with last year's 451, but there have been substantial increases in the number of birds seen in Alaska and Canada. This indicates that many birds hatched in the United States have reached the breeding age of five years or more and are re-occupying old breeding grounds in the north.

Practically all available breeding habitats in the United States were occupied by nesters during the past season, and very few suitable habitats remain. Nearly all of their former nesting grounds have been taken over by ranches, residential areas, airports, and oil wells. For these reasons, the trumpeter will never again become as common in this country as the smaller, less exacting whistling swan, although proper management and protection can save it from extermination.

Ewing Galloway photo

▲ TWIN whitetail fawns, one month old

A Dangerous Pet

You have often heard your state conservation department urge you to leave young wildlife where you find it. What can happen when you don't appeared in a United Press release.

According to this report, Mr. and Mrs. Seaton Barker, owners of a health resort near Colusa, California, adopted a fawn about four years ago and raised it on a bottle. All the neighborhood children made a pet of "Bambi," as the deer was called, and delighted in posing for pictures with their arms around the sleek neck of the now full-grown buck. Bambi was their playmate until a sudden change took place in his personality.

One day the deer was seen with blood on his antlers, and one Nick Miskulin was found dead near his car, his body trampled and torn by hooves and antlers. Later a posse shot the buck as it tried to break into an automobile in an attempt to reach two screaming women who had barely reached safety ahead of him.

What might have happened if this instinctive, seasonal aggressiveness had overtaken the deer at one of the children's photography parties is not pleasant to contemplate.

So leave young wildlife alone.

Announcing Sixth Annual High School Motion Picture Contest

Plans for the sixth annual national contest for the best school-made motion picture film have been announced. The contest is sponsored by the American Museum's Service Center in connection with the annual Audio-Visual Aids Institute programs.

The competition is open to all students of junior and senior high schools in the United States. The film must be 16 mm., planned and produced entirely by the pupils, and must not exceed 100 feet in length. A school may submit more than one entry but will not receive more than a single award a year. To enter the competition, the faculty adviser of the group of student movie-makers must secure an entry blank from the Museum, fill it out, and return it on or before May 15, 1951. The film must be sent to the Museum Service Center by December 1, 1951.

The selection of the winning film will be made by a panel of judges. In the event that five films come up to the standards of the Museum, an "Award of Merit" will be given for each of the films accorded second, third, fourth, and fifth places. Last year's "Oscar" was awarded to "Cat Anatomy," produced by students of Evander Childs High School, Bronx, N. Y.

Continued from page 151

lustrations give the work a significance that is much larger than the confines of the Sequoia National Park. The intelligent reader can learn from the type of ice sculpture found on Mount Whitney or Mount Russell, for example, the nature of the evidence that will enable him to read much of the geologic history of any glaciated mountain terrane. This is a work to be enthusiastically recommended to all who are interested in geology or in the high countries of the world.

H. E. Vokes

BIG HUGH

THE FATHER OF SOIL CONSERVATION

by Wellington Brink

The Macmillan Co., $2.75
167 pp., 1 illust.

HERE is the first full story of the life of a great American. As a youth, Dr. Hugh Bennett became aware of what erosion was doing to the soils of his own community. Later, as a young man, he went on to study this problem throughout the continent. For years he made little progress, however, as both soil scientists and the general public were largely blind to what was happening. Finally, in the early '30's, the "dust bowl" made Dr. Bennett's point for him in a manner so conclusive that there was no further need for argument. In 1933, the Soil Conservation Service was created and Dr. Bennett was chosen as its logical chief. At last, with a government agency charged with the job of doing something about the loss of the nation's topsoil, Dr. Bennett was able to swing into action.

The success of this agency, which Dr. Bennett still heads, is a tribute to his sound understanding of not only the processes of soil erosion and its control but the psychology of rural people. Through demonstration projects, and later the astutely conceived soil conservation district program, the American farmer has been aroused to the need for action to check soil erosion.

It is no fault of Dr. Bennett or the Soil Conservation Service that only 18% of the job has yet been done and that the Service's essential land capability mapping program is still far from completion. Unfortunately, far too many Congressmen are willing to save dollars at the expense of America's most priceless and irreplaceable asset, its fertile topsoil. No enemy could do as great damage as we are doing to ourselves as long as we fail to heed Dr. Bennett's warning to apply soil conservation measures promptly to every acre of agricultural land that stands in need of it.

Richard H. Pough

CAMELLIAS, KINDS AND CULTURE

by H. Harold Hume

The Macmillan Co., $6.50
271 pp., 76 illusts. (8 in color)

THE appeal of this interesting and authoritative work is chiefly to the camellia gardeners of the southern states and to those fortunate enough to own greenhouses. For such specialists Mr. Hume includes 70-odd pages of detailed descriptions of the numerous varieties of camellias, the majority of which are derived from six primary species. Especially interesting to the layman are the chapters dealing with camellia history. Through those pages we find wandering the shades of two early visitors to China and Japan. James Cunningham, a Scottish physician and employee of the East Indian Company, visited Amoy in 1700 and Chusen in 1702, where he secured plants and colored drawings of various sorts of camellias. Englebert Kaempfer, for whom *Azalea kaempferi* was named, was also a doctor. He was employed by the Dutch East Indian Company and in 1712 was stationed in Japan. The genus *Camellia*, incidentally, was established by Linnaeus in honor of another botanist, George Joseph Kamel. Also, the tea plant is a camellia! Camellias are natives of eastern Asia.

There are chapters on classification, propagation, soils, fertilizers, diseases, and greenhouse culture of camellias, to cite but a few.

The illustrations are mainly half tones, bound into the book in packets, as is today's bookmaking practice. In addition there are some line drawings, and several very fine reproductions in color appear at random through the book. There is a good index.

G. H. H. Tate

MEXICO IN SCULPTURE

1521-1821

Elizabeth Wilder Weismann

Harvard University Press, $7.50
224 pp., 169 plates

THIS excellent book deals with the sculpture of the Colonial Period in Mexico, which, as everyone who has traveled in Mexico knows, appears in tremendous richness and variety in the early churches and other religious buildings. Many must have shared my experience of having been charmed by the finer examples of this art yet overawed and confused by its quantity and the lack of any real guide to its meaning. *Mexico in Sculpture* provides the answer to much of my questioning. It informs me on how sixteenth century Spanish art combined with the native Indian tradition and then grew through the centuries into something new and unique. The significance of the story is not limited, however, to the history of sculpture. The author views her special subject as only a portion of the cultural whole and leaves one with a new understanding of the social conflicts engendered by the Spanish conquest of an alien civilization.

It is a serious, scholarly, and undoubtedly an authoritative book, written by someone who has been long absorbed in her subject. At the same time, however, the book has been designed in an extremely thoughtful and careful manner for the general reader. Its 167 excellent photographs illustrate the text with remarkable clarity. They are so carefully arranged within the book that the illustrations referred to in the text are almost always on the same or the opposite page, and one is not distracted from the course of his thoughts by the usual searching for plates. More detailed notes and references of interest to those wishing to enter more fully into the subject are grouped at the end of the book along with an extensive bibliography. In all, it is an exceptionally fine book, which should delight and inform a great many readers.

Gordon F. Ekholm

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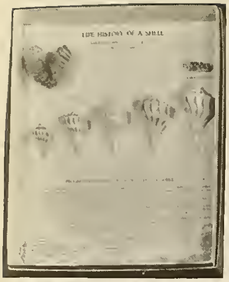
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ROYAL BRONZE

225 FIFTH AVENUE, ROOM 502, NEW YORK 10, N. Y.

Freedom and the Scientific Press

SEVERAL years ago on New York's lower East Side, a crowd gathered to hear a debate on rival ideologies. It was to be held in Labor Temple, an institution that through wars and social strife had stood as a symbol of Freedom of Speech. It had always been one of the few places where the little man as well as the big could be heard.

When the chairman tried to introduce the first speaker, the crowd voiced their feelings so strongly on both sides that he couldn't make himself heard. He waited and tried again but without success. Things began to fly through the air.

"Freedom of speech," he shouted, "is not freedom to drown out the other fellow. This place happens to be run by a church. That church probably doesn't agree with 90 per cent of what is said in this building, but it contributes about $50,000 a year to see that it *can* be said."

Silence fell. An orderly debate followed, and everyone went home the wiser.

Since that day, freedom of speech has been lost over more than half of Europe and Asia. With it went freedom of the scientific press.

How is freedom lost? One way is by the offer of a "new freedom"—freedom from responsibility. "Let the State do it for you," the argument runs. "Let the State decide what is better for you, and in return you will receive freedom from decision." This appeal to our sense of irresponsibility passes easily as a sort of Fifth Freedom. It has been one of the methods of tyranny from early times. It is no freedom at all. It is the Fifth Column against freedom. It is the short cut to slavery under the Super State.

Dictators and governments itching for total authority naturally seek control over science. Science is the search for new tools, new weapons, new ways of life. It is the total of man's efforts to push back the frontiers of ignorance and make a better physical world. Control of science means a subtle control over a large part of life.

Science cannot help humanity under the Super State. Human hopes cannot survive under it; no life is safe. Under the Super State, even a little child is a Thing.

So this is an appeal to you to cherish your right to know what science is doing and to decide what is a better life and what isn't. In NATURAL HISTORY, we try to give you the best in scientific truth through independent opinion. When you read what Jones says, it isn't Smith with his whiskers shaved off or Brown wearing dark glasses. It is someone who knows the subject, giving his honest belief. It is for you to agree or reject. You need not stop thinking for yourself.

Scientists in great heroism have fought for their right to seek the truth wherever it lies. Persecution equaling that of the martyrs has often been their reward. They choose to be the first by which the new is tried, and not a few have paid with their lives. Can you lightly hold the privilege their knowledge gives you? Be careful about handing it over to a self-styled expert.

Science itself is neither good nor bad. Scientific planning is necessary for the creation of a better hospital. But in Hitler's Germany, something that called itself scientific planning for population improvement produced the gas chamber.

Science itself is not the miracle. The miracle is the fearless will to use it well.

EDWARD WEYER, JR., *Editor*

LETTERS

Fish Movements

SIRS:

While watching small fishes kept in a large jar, I noticed that they rise and fall slowly without any apparent outside motion. Will you be so kind as to give me an explanation of how this happens? Do they take in air or water when they move down and expel it on rising?

MARIANO HERNANDEZ

Monterrey, N. L.
Mexico.

C. W. Coates of the New York Zoological Society offers the following comments:

It should be pointed out that fishes can move not only by means of their fins but also by means of the jets of water emitted from their gill covers during the course of breathing. Unpublished investigations have demonstrated that in the goldfish this water can be very nicely regulated both as to direction and amount, and that the fish apparently uses this as a means of making relatively minor adjustments in the three-dimensional space in which it moves.

Large movements are, of course, effected by the fins and the caudal portion of the body, the latter being the principal organ of forward locomotion.

We suspect, however, that your correspondent failed to notice the very slight and delicate movements of the fins in which practically all fishes indulge almost continuously, save when actually resting on the bottom. Since most fishes have almost the same specific gravity as water, being able to adjust the amount of gas in their swim bladder to accomplish this, it takes but very little movement of the fins to cause a change in position.

She's Without He's

SIRS:

"A Desert Walking Stick," by Lewis Wayne Walker, in the March issue of NATURAL HISTORY, intrigues me. Do walking sticks live only in the desert? About a year ago, as I took my car out of the garage, I found one right on my windshield. I realized at once that it was an animal and not a twig, for it moved and was just like the pictures I had seen of them. I carefully picked it up and placed it on a bush, where it then could not be distinguished from a twig. In all, it was about two and a half or three inches long. What was it doing in southern Louisiana, where this encounter occurred?

MRS. ANDREE DESBRIERE IRWIN
Madisonville, La.

The following answer is offered by Dr. Mont A. Cazier of the American Museum's Department of Insects and Spiders:

Walking sticks (Phasmids) are not confined to desert areas. As a matter of fact, they reach their greatest development in numbers, size, and form in the tropics, where some species attain a body length of from nine to thirteen inches. Many of the species mimic twigs, but in the moist tropical jungles, especially in the East Indies, they also resemble leaves. There are about 300 known genera and 2000 described species in the world. In this country, there are about seven genera and twelve species, all wingless except one species in Florida.

Although several species occur in Louisiana, one of the most interesting is the "Musk Mare," *Anisomorpha buprestoides* (Stoll). This insect has glands beneath the prothorax which exude a white fluid of a peculiar but pleasant odor. The specimen found in southern Louisiana by Mrs. Irwin might belong to this species, which is native in that area.

The walking sticks are strictly vegetarian and are usually found on bushes or trees. They move slowly, and one of their most striking accomplishments is that of death feigning. Development is rather slow, and it may require one and a half years to complete the life cycle. In most species both sexes are known, but in some the males have never been found, and these species reproduce parthenogenetically. In other words, the eggs are developed in virgin females without fertilization by the male. Scientists do not believe the males exist. In these cases, reproduction can apparently continue indefinitely without them.

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Ewing Galloway photo

THE FRIENDLY CHIPMUNK *heralds warm weather and sunshine and crams its cheeks with proferred food*

Another Tropical Cry

SIRS:

If you will allow me a second question, it concerns the article "Poor-me-One," by William E. Lundy. When on the coast of Brazil not far from the jungle, and also in Manaos, I used to hear in the night something heartbreaking, which no one could identify. But instead of the cry starting high, it started low and went up and up and up, to a pitch so high that it reached the end of endurance. It would stop for awhile, then start all over again. To my way of interpreting the sound, it was like "swee, swee," etc. What was it? I heard it only in Brazil, never in Panama, Colombia, or Trinidad.

MRS. ANDREE DESBRIERE IRWIN
Madisonville, La.

The following remarks are offered by Dr. John T. Zimmer, of the American Museum's Bird Department:

Without being able to give an unequivocal answer to Mrs. Irwin's query, I

Continued on page 240

NATURAL HISTORY

The Magazine of the American Museum of Natural History

F. Trubee Davison, President
Wayne M. Faunce, Vice-Director
In charge of Publications
Albert E. Parr, Director

VOLUME LX—NO. 5
MAY, 1951

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You will find Natural History *Magazine indexed in* Readers' Guide to Periodical Literature *in your library*

THE COVER THIS MONTH

When the mule deer fawn senses danger, its head rises attentively and its huge ears swing around like radar antennae. Then it becomes obvious that the mule deer gets its name from these unusual ear trumpets. When it is older, its mulelike ears will be even more important in helping it to escape danger, for then its mother will no longer be watching closely over it.

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The orphaned fawn on the cover was only two weeks old. It was raised on a bottle in the Jackson Hole Wildlife Park and then released.

Tom McHugh

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INTRODUCING THE UNIVERSE

- - - - - - - by James C. Hickey

Dodd, Mead and Co., $3.50
154 pp., 18 illusts.

THIS well-written book presents a concise, over-all picture of the universe, of the planets, stars, constellations, and other physical objects that are to be seen in the skies. It also touches briefly on the forces that dispose of these objects and gives something on various theories that have been advanced to account for what can be seen and measured.

The text is directed at the layman, and it will be a wise selection for anyone who desires to obtain the basis for sky study. The author conducted a column on "Stars of the Week" in the New York *Sun* and is familiar with the type of information most commonly sought by the public.

The treatment is the logical progression from the nearest and best understood of the celestial bodies out into the uttermost reaches of space. The reader will frequently marvel at the precision of a science that can learn so much at such great distances. Certain problems always come to mind when a person puzzles over affairs beyond the limits of our earth, such as the presence of life on other planets, the origin of our earth, or how our world might come to an end. Discussions of such topics are practical and limited to such aspects as are supported by facts. There is no sensational speculation.

The book is well illustrated by half tones and has end-paper maps showing the constellations over the four seasons.

I believe a person with little or no knowledge of astronomy will understand this book readily, will acquire a better than average background by reading it, and will not find the process a dull chore of study. I also believe a reader who already knows enough to snoop around the heavens will find this book a handy reference and a helpful one to lend to friends who show an interest in the subject. It is not the sort of book that, once read, is laid aside and forgotten.

HAROLD E. ANTHONY

GENESIS AND GEOLOGY

A STUDY OF THE RELATIONSHIPS OF SCIENTIFIC THOUGHT, NATURAL THEOLOGY, AND SOCIAL OPINION IN GREAT BRITAIN, 1790-1850

- - by Charles Coulston Gillispie

Harvard University Press, $4.50
315 pp.

THE furor over Darwin's *Origin of Species* may be viewed as marking the end rather than the beginning of an intellectual revolution. One, at least, of the basic issues had begun to appear before the end of the eighteenth century and had been fought through in the science of geology before Darwin's work transferred the battleground to biology. The issue was not, Gillispie shows, so much one of religion versus science as of religion *in* science. Until this issue was joined, no real separation between science and religion was commonly recognized. Science, as "natural philosophy," found the workings of Divine Providence everywhere in nature. Religion, in "natural theology," argued for a materialistic approach to God.

The modern science of geology arose through two great controversies: first between "neptunists" and "vulcanists" and then between "catastrophists" and "uniformitarians." Most of the disputants on both sides considered themselves pious men working for the glory of God. Yet in each case one school (neptunists, catastrophists) was more amenable to then orthodox theological interpretation than the other. Probably the most basic issue was not denial of the Creator, Whose existence no reputable scientist then questioned, or even the literal interpretation of the Bible, although this point was argued. The question was, rather, whether the Creator has continued providentially to intervene in the operation of His universe.

That God has thus intervened was the dominant view of both theologians and scientists until the nineteenth century. Yet the geological controversies finally established that this view is entirely untenable in the field of geology. (It had already become untenable in the physical sciences, and the last phase, centered on Darwin, was to make it untenable also in biology.)

It became necessary to choose between three alternatives: to separate science and theology as quite different fields without common subject matter, to reject the well-established findings of science, or to change theology in accordance with science.

That is the theme worked out in considerable detail by Gillispie in the present book. Limitation of the scene to Great Britain is restricting, and omission of the period after 1850 is like leaving out the last act of a drama, but the result is a clearer focus and concentration on material less familiar than the Darwinian controversy. The book is well written, and, although strictly scholarly in tone and method, it should appeal to anyone sincerely interested in intellectual history.

G. G. SIMPSON

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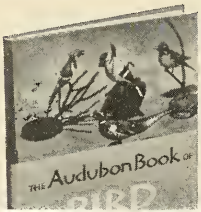

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THE MALAYS—A CULTURAL HISTORY

--------by Sir Richard Winstedt

The Philosophical Library, $3.75
198 pp., 8 illusts.

IN view of the scattered condition and the multilingual character of the sources, every student of southeast Asia and Indonesia will greatly welcome this synthesis of the cultural history of the Malays. The main chapters of the book cover such aspects as origin, migration and language, beliefs and religion, social, political, legal, and economic systems, literature, arts and crafts, etc. This gives some indication of the very wide scope of the study. However, there is a marked inequality in the treatment of the various subjects, a weakness this study shares with most of the other surveys of this area. Thus, although we are given a summary of Early Man in this area from Pithecanthropus and Meganthropus through Solo and Wadjak man to the mesolithic skeletal remains, this survey is rather sketchy, as is also the survey of the archaeology of the area, based mostly on the findings of Heine-Geldern, Stein-Callenfels, and other authorities. There is, however, a good analysis of the Dongson Culture. The physical anthropology of the living races is almost entirely neglected.

In contrast to most of the summaries previously published, the book is more strongly orientated toward historical considerations, not only in its emphasis on migrations but also in its attempts to trace the probable sources of single elements of culture. Thus, the shamanism of the Malays, which is so conspicuously absent from most of the other Oceanian peoples, is derived from the Mongoloid strain that penetrated also the physical make-up of the Malays. The hysterical condition underlying the institution of shamanism, in the author's opinion, not only prepared the way for later Sufi mysticism, but has been a motivating power in Indonesian politics. The clear recognition of the continuity of such a mental condition can, in fact, contribute greatly to a better understanding of even the present-day situation.

The historical approach of the author is also manifest in his minute dissection of various cultural elements into their original Malayan or Proto-Malayan layers and their later Hindu and Islamic additions. In this analysis he also offers delightful reading to the student of acculturation in an area which lends itself as few others do to such a study. And he does so without the theoretical burden with which so many other studies of acculturation are overloaded. Altogether, therefore, the book is an excellent introductory text for the student interested in this area.

ALPHONSE RIESENFELD

EASTERN BROOK TROUT

------------ by Bob Elliot

W. W. Norton, $5.00
242 pp., 19 illusts., 3 in color

THIS is an excellent book on the speckled trout, the trout of our boyhood—the trout that is not a trout but a charr. Like the grouse, our brook trout cannot stand against the march of civilization, and with the deforestation and consequent warming of the streams, it has retreated to its last great stronghold in northeastern United States and Canada.

It is fitting, therefore, that such a fine work should be compiled by a State of Maine man. The author, an expert fisherman, has spent a lifetime in the study of and quest for the brook trout. He has acquired a fund of knowledge that is expertly set forth in his book.

To the probable disgust of the dry fly purist, the author points out that most of us have started our knowledge of fishing for the brook trout with the lowly worm, and with this in mind, he includes in his descriptions of the various methods of angling a treatise on worming for trout. To that fisherman who has not as a boy felt the lusty tug of a good trout on a worm rig, the sympathy of this reviewer goes out. Indeed, he has missed one of the great thrills of life.

There is an excellent chapter on flies, both wet and dry, as well as streamers and bucktails. There are lists of patterns and a compilation of the favorite flies of famous anglers. The author discusses places to fish in Vermont, New Hampshire, and Maine, as well as in the Canadian provinces. He also enumerates some of the western waters as they pertain to the brook trout. He intersperses the book with tales from his own experience on lake and stream, which season the more technical parts.

Rods, lines, reels, and leaders are talked about; and, believe it or not, there is an interesting chapter on the keeping and cooking of trout. This man is not content with getting you to catch trout; he stays with the readers until the final morsel is eaten before the dying campfire! This is a book for the novice as well as the expert.

F. WILLIAM RANDEBROCK

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MEN OF OTHER PLANETS

- - - - - - - - by Kenneth Heuer

Pellegrini and Cudahy, $3.00
160 pp., 28 illusts.

THIS book has a very challenging title which, unfortunately, raises expectations a reading does not satisfy. It would have been safer to call it "Life of Other Planets." There seems to be a basis for argument on the presence of life outside the terrestrial sphere but so little reason to include man (as most people will interpret the title) as an element of it that false pretenses exist from the start.

The author establishes a factual background for the heavenly body under discussion—the moon, the sun, or one of the planets—and then introduces life into an inauspicious environment by a species of wishful thinking which is in decided contrast with the meticulous precision expected of astronomers. His whimsical fancy is reflected in the illustrations of other-world areas which suggest either too much or too little, depending on whether you expect science or fiction.

H. G. Wells wrote good fiction about the life on other planets. Wells had no scientific data to prove his Martians existed; he created them out of his imagination. But he imposed the minimum strain on the reader's credulity by striving for plausibility, keeping within commonly recognized physical laws and assuming that the behavior of life from Mars would be consistent with human knowledge of vital processes. Another type of fiction woven about extraterrestrial life is the Buck Rogers comic strip sort, vigorous, dramatic, and bold in concept.

As opposed to the fictional treatment, there is the carefully considered statement that confines itself to the actual evidence for the existence of life on other worlds and balks at futile fancy.

The book under discussion cannot be catalogued definitely as good fiction or good science. It attempts a compromise and suffers in consequence. It has good science in it as long as the author sticks to pure astronomy; when he assumes to cover the biology of the heavens, he certainly leaves the reader "up in the air."

HAROLD E. ANTHONY

THE NATURE OF THE UNIVERSE

- - - - - - - - - - by Fred Hoyle

Harper and Brothers, $2.50
142 pp., 12 plates

IF you are capable of intellectual excitement, start reading this little book, and hold onto your hat! You will not put it down until you reach the last page, and when you do, you will have been whisked at breathless pace from one end of the universe to another and through endless eternity. You will have been given a lucid, brief, but (unless you are an astronomer) sufficient account of the structure of the solar system, the galaxy, and the universe. You will also have been given recent, mind-stretching theories to account for the structure and history (past and future) of the earth, the stars, and the whole of the physical universe.

Hoyle's book is being compared with earlier popular works of similar scope by Eddington and by Jeans. To me, those authors achieved nothing like the pace, boldness, and impact of Hoyle. His style is easy, conversational, and simple—almost deceptively so, for the simplicity overlies extraordinary complexity and subtlety of thought.

No qualification is needed in saying that this book is fascinating, but be careful not to let its fascination wholly overcome your judgment. Hoyle is brief and direct. He does not argue or discuss; he tells you. In fact, much of what he tells you is highly speculative and controversial. It is proper scientific speculation and theorizing, extrapolating from observations and accepted principles, but in spite of the positive presentation it goes far beyond what can be called established at present.

Much of the value of the book arises from its scientifically imaginative quality, but some clearer warning as to where fact ends would not have been amiss. Everything Hoyle says might perhaps prove to be so—but most of us (and probably Hoyle, too) would be rather surprised if it did. I find, for instance, that his conclusion that there are about 100,000 planets in our galaxy inhabited by something like humans depends on so highly tenuous a chain of unproven hypotheses and assumptions as to be only the barest of possibilities. But isn't it an exciting possibility!

G. G. SIMPSON

THE SHELL COLLECTOR'S HANDBOOK

- - - - - - - - by A. Hyatt Verrill

G. P. Putnam's Sons, $4.00
228 pp., 16 plates, 89 text figures

THERE has long been a need for an adequate handbook for beginners in malacology, and it is unfortunate that this book has fallen so far short of answering this need. Mr. Verrill's book is interestingly written, but it contains more misconceptions and errors than most books published on this subject since the early 1800's. The following examples of the author's curious concepts illustrate the character of the book. In the sixth line of Chapter I, Mr. Verrill puts all shells in the *order* Mollusca. The Brachiopoda have not been included with the Mollusca since the classic work of E. S. Morse in 1873. On page 88 he says: "Like the drilling shells, the Teredos have sharp, saw-like teeth in their proboscis and with these simple tools they bore into the hardest wood or even into soft rock with the greatest of ease." No Teredo, or any other bivalve for that matter, has teeth or a proboscis equivalent to these organs in a gastropod. The pallets, or "drills" as Verrill calls them, function as a plug to close the entrance of the burrow when conditions are unfavorable to the animal. They have nothing whatsoever to do with drilling. Mr. Verrill is the first to report Teredos living in soft rock. I would certainly like to see them.

In comparing bivalves and gastropods the author says, "the creature [gastropod] also possesses two pairs of tentacles." Such generalizations are misleading and entirely wrong. All of the *Prosobranchs*, an entire subclass of the Gastropoda, and all of the *Basommatophora*, an order of the Pulmonata, have but *one* pair of tentacles, and these groups contain the majority of the Gastropods.

Mr. Verrill again prints the old fallacy that "any pearl would be ruined by cooking." Boiling does not destroy the iridescence of the nacreous layer. Pearls produced by the common edible oyster have no nacre, and the fallacy undoubtedly arose from the fact that people found pearls in their stew and thought they had been destroyed by cooking when they were valueless in the first place.

In general, the chapter on "How to Make a Collection" is good and might prove stimulating to beginners, but it is certainly hoped that they will not use formaldehyde to clean or preserve any shells. Nothing could be more destructive to the shell.

The last six chapters of the book, which are devoted to the shells of different geographical regions, are so vague and generalized that they are almost useless.

The plates on the whole are good, but unfortunately no indication of shell size is given. Large and small shells are often illustrated in about the same size, a very misleading thing for a beginner who has nothing to go by. The text figures are in most cases rather poorly drawn and in several cases erroneous.

R. D. TURNER

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For 50 years the *Readers' Guide to Periodical Literature* has been a great help to everyone who uses a library. One hundred seventeen periodicals are indexed in this Guide, which is brought up to date monthly. As readers of this magazine know, NATURAL HISTORY has been indexed in the *Readers' Guide* since 1941.

—ED.

Pin-pointing the Past wit

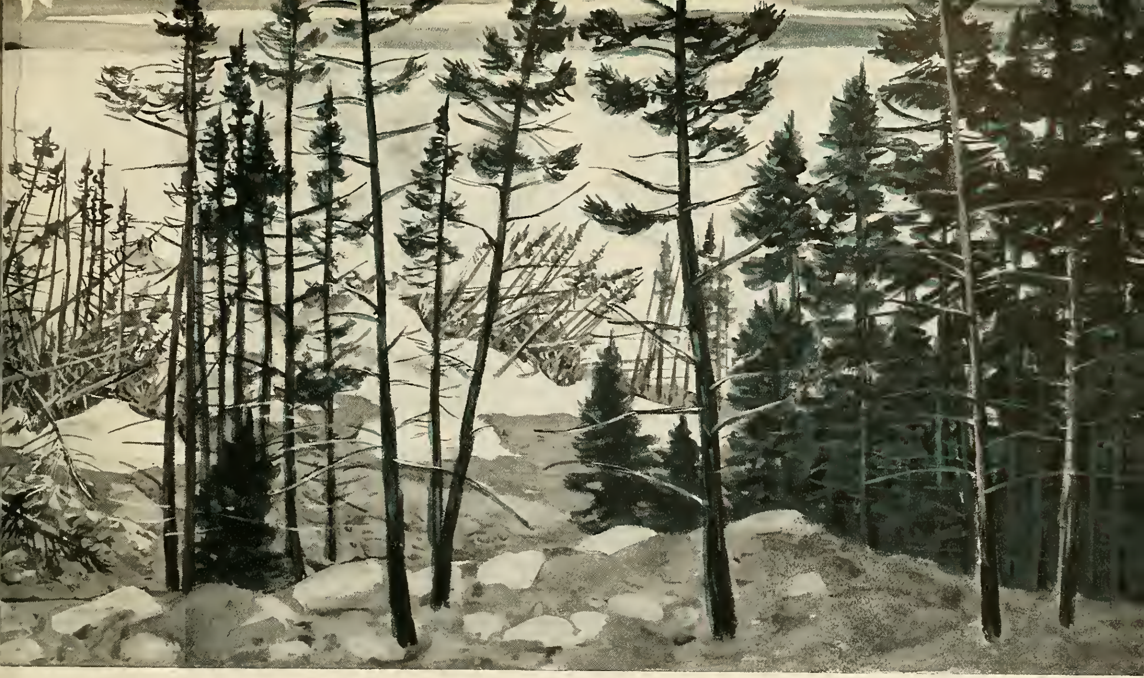
IN a Chicago laboratory a radiochemist stood before an oscilloscope connected to a Geiger counter. Across the oscilloscope screen, very much like the screen in a small television set, jumped a never-ending ribbon of green zigzags. The zigzags were made by the impulses coming from disintegrating atoms of radioactive carbon within the counter. The carbon had been extracted from a piece of wood, but the wood was by no means ordinary. In fact, it was a piece of very old wood, part of a spruce tree that grew in a Wisconsin forest so long ago that when the tree was alive the Ice Age still had northern United States in its chill grip. So long ago that mastodons and mammoths still inhabited the country in force. Indeed, it is quite possible that a mastodon, crashing through the spruce forest in the chill glacial air, brushed against this very tree.

The wood had been sent to the laboratory for an exact determination of its age—not the age of the living tree, which can easily be learned by counting its growth rings, but the time elapsed since the tree was alive. When a police surgeon examines a dead body, his medical skill tells him *about* how much time has elapsed since death occurred. But only *about.* He has no means of fixing the time exactly, even though the guilt or innocence of a person accused of murder may depend upon it. The surgeon can only look for certain signs and use his professional judgment.

Like the surgeon, geologists and archaeologists, trying to date the events of prehistoric periods, have only been able to look for signs and on the basis of them to make estimates which, although far better than nothing at all, are certainly not accurate. Some geologists, for example, had estimated the age of this particular spruce forest in Wisconsin at about 25,000 years, although they could not be sure.

The uncertainty, however, was being ended by the green zigzags that continued to jump across the oscilloscope screen. Radiocarbon, the cause of the zigzags, is a recent discovery that promises to make an accurate timetable of prehistoric events. It constitutes a kind of clock that set itself going when the forest tree died and that has been ticking ever since, at a known rate. The piece of wood was the latest of five samples, all collected from the same forest. When tested, all five gave answers very close to each other, and the average of them reads: 11,400 years ago—six times as long ago as the birth of Christ—and the date is probably accurate to within a few per cent.

This date is of tremendous importance to science, for it cuts earlier estimates and guesses more than in half and brings the extinct mastodons and mammoths (among other things) much closer to our own time than had been supposed.



▲ A GLACIER wrecking a forest in Alaska. The ancient catastrophe in Wisconsin dated by the radiocarbon clock must have looked the same, except that the ice cliff was far higher

the COSMIC CLOCK

One of the most revolutionary discoveries of the twentieth century illuminates prehistory as never before and brings Ice Age man much closer to our "back door"

By Richard Foster Flint

Professor of Geology, Yale University

Drawings by Matthew Kalmenoff

Thanks to radiocarbon, we can look forward to the enjoyment of talking about prehistoric dates in figures that are almost precise.

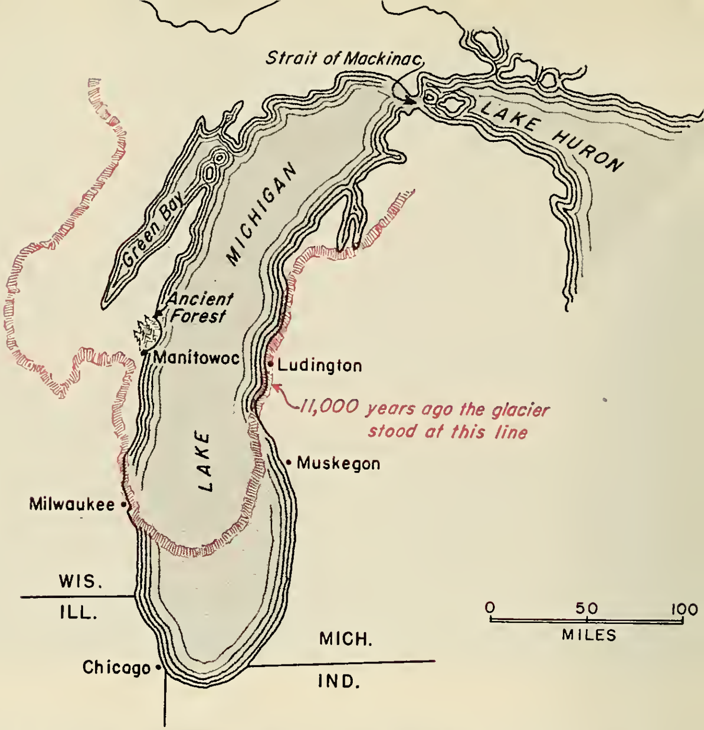
How this has been made possible is a story of research in nuclear physics and in chemistry, with important contributions from archaeology and geology. It is a story of co-operation among scientists, a pooling of knowledge in several fields. The pioneers in this unusual research are Dr. W. F. Libby and Dr. J. R. Arnold, and they did the work at the University of Chicago's Institute for Nuclear Studies.

What Is Radiocarbon?

The story of the research that has led up to this result shows the extent to which science has become integrated, with contributions from nuclear physics, chemistry, archaeology—and a few additions from geology, the field of sanitation, and antarctic exploration!

It all grew out of research on cosmic rays. These are great streams of neutrons that pour in to the Earth from outer space. They bombard the Earth's atmosphere and set up a sort of chain reaction that showers cascades of particles down through the air to the Earth's solid surface, where their arrival is pictured on the oscilloscope screen.

Many of the invading horde of neutrons, penetrating the Earth's atmosphere, collide with atoms of nitrogen, of which the atmosphere is largely composed. When one of these high-speed collisions occurs, a new nucleus is created. This disintegrates, emitting in the process an atom of a newly created element, Carbon 14. In this way great quantities of Carbon 14 are created, miles above the Earth's surface, like sparks struck by an impact. Like sparks, too, the Carbon 14 atoms do not last long, for they are radioactive, and they destroy themselves through spontaneous disintegration. Carbon 14 is "heavy" carbon. It is "heavy" because, whereas ordinary carbon has an atomic weight of 12, the weight of the new carbon is 14. The new carbon isotope is familiarly called, by the



scientists who study its characteristics, *radiocarbon.*

Although radiocarbon atoms may not last long, still, while they do exist, they get around. The first thing they do is combine with oxygen to form carbon dioxide. This mixes with the ordinary carbon dioxide that contains ordinary carbon and in the course of time becomes evenly mixed throughout the air that surrounds the Earth's solid surface. Wherever we may be, as we breathe we draw into our lungs heavy carbon in this form.

That doesn't mean, though, that radiocarbon is very abundant. Actually, for every trillion atoms of ordinary carbon in the atmosphere there is only one atom of the heavy Carbon 14! So, although we are constantly breathing "hot" carbon, its "hotness" is almost unbelievably faint, and we are none the worse for it.

The proportion of Carbon 14 to Carbon 12 in the atmosphere is believed to be constant. This should be so because it represents a balance between the supposedly steady rate of creation of radiocarbon and the rate of its destruction through its own disintegration.

Both plants and animals absorb carbon dioxide freely from the atmosphere. Probably, therefore, they contain just the same proportion of radiocarbon to ordinary carbon—one to about a trillion—that is present in the air. To be sure, the radiocarbon in plant and animal tissues is constantly disintegrating, but it is being renewed as constantly from the air.

A Calendar of the Past

This continuous renewal of radiocarbon goes on as long as the plant or animal is alive. But when death occurs—in a tree, for instance—the intake of atmospheric carbon ceases abruptly, and so new radiocarbon no longer comes in to replenish what is being continuously lost by radioactive disintegration. Thus from year to year the amount of radiocarbon present in the dead wood becomes gradually less.

The rate of decrease of radiocarbon is the same everywhere, and the rate is known. Because of this it is possible, by measuring the amount of radiocarbon left in the dead wood, to calculate the time that has elapsed since the death of the tree. Actually it isn't the *amount* that is measured; it is the *rate* of disintegration, which constantly diminishes and is always proportional to the amount of radiocarbon remaining. It is the tiny disintegrations—so many per minute per gram of carbon—that produce the green zigzags on the oscilloscope. The measurement is a tricky laboratory operation, one that must be watched carefully at every stage and that must be safeguarded against possible errors of several kinds. But thanks to skillful development, it works.

How the Calendar Was Developed

The radiocarbon calendar is the culmination of a long train of necessary research, without which the calendar would have no value. More than fifteen years ago it occurred to Dr. A. V. Grosse, radiochemist of the Houdry Process Corporation of Pennsylvania, that bombardment by cosmic rays probably was creating new radioactive elements. Later, this idea led Dr. Libby to believe that "heavy" carbon, created in that way, must be found in living matter. To test this theory, Libby and Grosse obtained from the Department of Public Works of the City of Baltimore a sample of sewage, a pure organic product. Analyzing it, they not only found radiocarbon in it; they also found that radiocarbon was present in just about the proportion they had calculated beforehand.

The next step was to make tests to see whether this same proportion of radiocarbon is present in living matter all over the world. So they obtained samples of wood from Chicago, New Mexico, Panama, South America, a Pacific island, Australia, North Africa, and Sweden and tested them for radiocarbon. This is a pretty good geographic distribution. But seashells (calcium carbonate) from Florida and seal oil specially collected by the Ronne Antarctic Expedition were tested also; and in the whole lot, radiocarbon proved to be present in the same proportion, within the limits of experimental error.

The success of these tests made it seem possible to take any piece of ancient wood or other carbon-bearing organic substance and determine its radiocarbon date. So it was decided to check radiocarbon against historical knowledge. The method was to determine the radiocarbon dates of pieces of wood and to compare these dates with the dates already calculated by archaeologists on the basis of historical evidence. This was done with a variety of samples, and the archaeologists no doubt had an interesting time selecting them. Two of these were pieces of wood from Egyptian tombs known to be about 4600 years old. The radiocarbon dates came out within 150 years of the historians' figures.

Although it was apparently true that the proportion of radiocarbon to ordinary carbon is uniform in all living matter, regardless of its location, and although the tests on Egyptian wood seemed to show that this proportion has been the same during the last 4600 years, this was not the end. For it was not yet proved that the same held true for still more ancient times, more than 4600 years ago. To prove this it would be necessary to test still older material. But there is one difficulty about all such very old objects. Their dates are unknown; therefore, they provide nothing with which to compare the radiocarbon dates.

There was only one thing to do: get radiocarbon dates for a large number of samples, collected from many different geologic and archaeologic deposits, compare them, and see whether the dates were consistent with each other. If they were, it could be fairly concluded that the concentration of radiocarbon had been very nearly constant throughout the whole period represented by the samples.

The selection of all these samples demanded the co-operation of a number of specialists. So the American Anthropological Association and the Geological Society of America were asked to name a committee of four specialists to collaborate with Libby and Arnold in the tests. As a result, more than 200 samples were collected and dated. Their ages ranged back more than 15,000 years.

The results were so generally consistent with each other as to leave little doubt that the radiocarbon calendar is reliable for dates as far back as it can reach. Unfortunately, however, its reach is limited, and for a simple reason. The rate at which radiocarbon disintegrates is comparatively rapid—so rapid that 5568 years after a plant or animal has died, the radiocarbon it contains is half gone. Although the rate gradually diminishes with time, still the proportion of radiocarbon remaining at the end of 20,000 years is so small as to make accurate laboratory counting very difficult. It is not likely that any refinement in technique will stretch the reach of the calendar much beyond 30,000 years.

Still, we must not ask for too much; during the last 20,000 to 30,000 years a great many things have happened, the dates of which science wants very much to know.

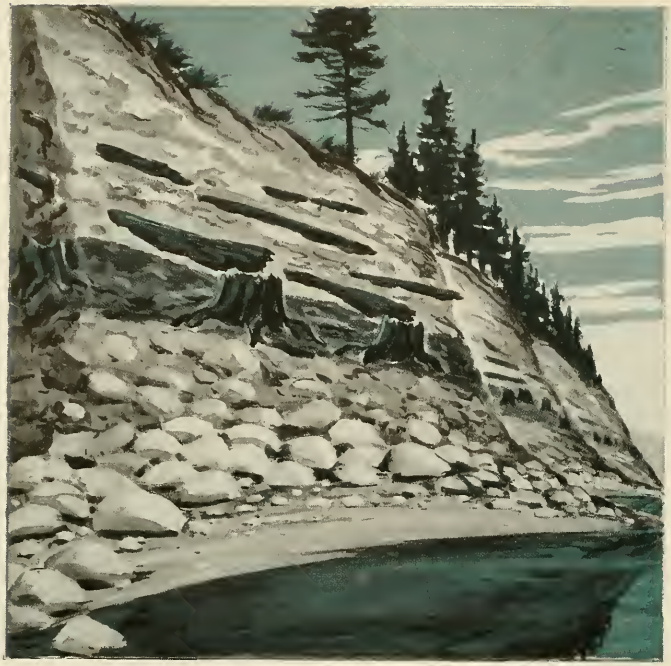
History of the Ancient Forest

At this point we can return to the ancient Wisconsin spruce forest from which we got the sample of wood we began with. The forest is buried beneath a thick layer of earth and stones plastered over it by the great glacial ice sheet that —not so long ago, as we have seen— flowed into the United States from Canada. Because of its burial, the forest would have been unsuspected if the ground had not been deeply cut into by the waves of Lake Michigan. In the course of time the Lake has created a bluff, or cliff, in which the ancient forest is exposed as a dark-colored layer of peat. Thanks to meticulous studies made by Professor L. R. Wilson of the University of Massachusetts, the peat has been described almost inch by inch. In it are spruce stumps still rooted in the ground beneath the peat. All the stumps are splintered. Many spruce logs lie in the peat or in the earth above it, all of them pointing southwest, the direction in which the invading glacier moved. Some of the logs are flattened, as though a great weight had pressed on them. Furthermore, their butts are splintered and twisted as only green, living wood splinters. From these facts it cannot be doubted that the trees were overwhelmed by the glacier, which snapped them off as a giant bulldozer might have done and then overrode the prostrate wreckage, smearing stony clay across its top.

When the logs were sawed through, they revealed confirmatory evidence. The oldest of the trees has 142 annual growth rings; so it is sure that the forest existed for at least 142 years before it was destroyed. The few outermost or youngest rings are closer together than the ones inside them, showing that during the last few years of their lives the trees were growing poorly. The reason for the poor growth is not far to seek. The upper part of the peat, unlike the peat layers beneath, consists only of mosses that live on wet ground or in water itself. The topmost moss plants are still upright, just as they grew, and their youngest branches are thin and scraggly. Water-laid clay overlies the plants and is packed around their stems, as could be the case only if it had been deposited while the mosses were still growing.

Clearly, what slowed the growth of the trees and what killed the mosses was a muddy lake, which must have flooded the spruce forest for several years before the final catastrophe. The lake could only have been created by the advancing glacier, which, by blocking the Strait of Mackinac, dammed up the water in the Lake Michigan basin and caused the lake gradually to rise. Meanwhile the glacier continued to flow southward, so that by the time our spruce forest had been standing in muddy water for several years, the moving wall of ice stood towering above it, ready to complete the task of destruction.

Following the track of this glacier, geologists have found the ridges of earth and stones that mark its outer limit only 25 miles southwest of the buried forest. They



After photos by L. R. Urlson

▲ THE WISCONSIN LOGS were exposed by wave action on the shore of Lake Michigan. Clearly the great glacier had snapped the trees off and buried them

have traced this outer limit nearly as far south as Milwaukee, and, on the eastern side of Lake Michigan, to a point between Ludington and Muskegon. Between Milwaukee and Muskegon the glacier formed a great tongue that projected southward.

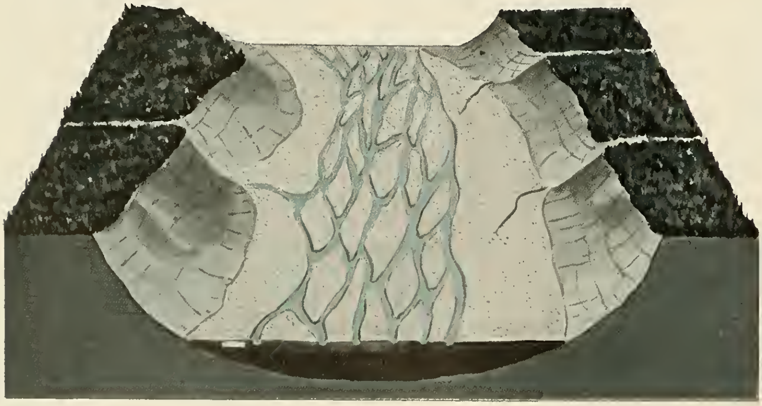
The radiocarbon calendar has given a date—11,400 years—for the destruction of the spruce forest. No buried wood has yet been found nearer than this to the outer limit of the glacier; so geologists have to resort, for the present at least, to their former method of estimating. From what is known about the rates of present-day glaciers, a reasonable estimate of the time required for the ice to flow from the forest site to its extreme and final limit is 400 years. Therefore we can say, provisionally, that the glacier stood at its final or "Milwaukee" line about 11,000 years ago, and from that line it began to melt away.

Matching Up Ice-Age Events

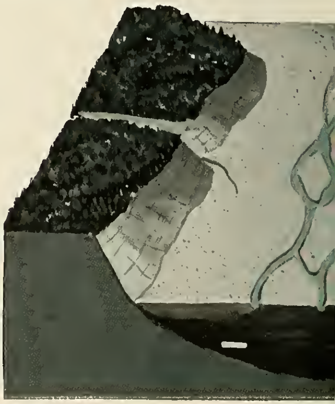
Away down near St. Charles, Missouri, close to the point where the Missouri River empties into the Mississippi, a group of geologists found, in 1949, a log of wood imbedded in the base of a terrace, the top of which stands 50 feet above the river. They recognized the terrace as the remnant of a deposit made when the Mississippi and the Missouri were choked with sand and silt poured into them by melting ice from the glacier hundreds of miles to the north. Gradually, the rivers silted up their valleys with these "melt-water" sediments, until in time their beds stood 50 feet or more above their present positions. Sediment 50 feet thick, filling a valley more than a mile wide through a distance of hundreds of miles, forms a very bulky deposit.

When the glacier melted away, it ceased to pour extra sediment into the big valleys. The two great

▼ THE ST. CHARLES LOG, far south of the glacier, fitted into the same story. Between 11,000 and 12,000 years ago, the river, choked with silt, had floated the log in and left it buried in the ever-increasing deposit



▼ ABOUT 10,000 YEARS AGO (*center drawing*) the river, still fed by the melting glacier, had buried the log



rivers, no longer burdened with superloads of sand and silt, could then cut down into the thick sediments they had been obliged to deposit on their floors during the glacial invasion. With their great volumes of water they succeeded in flushing much of the accumulation away, but in protected places along the valley sides flat-topped terraces of sand and silt remained as witnesses to the former great fills of glacial waste. St. Charles is one of those places.

All this was apparent to the group of geologists as they examined the log projecting from the terrace sand. They realized further that the log must have been floated in and deposited as driftwood during the time when the river was choked with glacial sand. They guessed that the ice invasion was probably the one in which the ice in the Lake Michigan basin stood along the "Milwaukee line," straddled the Mississippi at Minneapolis-St. Paul, and stood in the Missouri valley at Yankton, South Dakota.

All this seemed probable, though it wasn't proved. But thanks to radiocarbon, several months later it *was* proved. A sample of wood from the log was sent to the laboratory, reduced to carbon, put into the counter, and the automatic counting was begun. Result: the log proved to be just a few hundred years older than the Wisconsin spruce forest. Clearly the choking of the rivers had begun while the ice stood somewhere north of the "Milwaukee line," before, but not long before, it overwhelmed the forest. Radiocarbon had proved a close connection between two events that occurred more than 11,000 years ago at places hundreds of miles apart.

For the group of geologists who were trying to decipher the history of the Ice Age it was a godsend. To have established by ordinary geologic methods even an approximate relation in time between the driftwood log and the buried spruce forest would have required years of difficult and painstaking measurement of the terraces along the Mississippi River between Wisconsin and Missouri.

Prehistoric Man in America

One of the important ways in which the radiocarbon calendar can add to the history of America is by dating the races of prehistoric man that lived on this continent thousands of years before the coming of white Europeans, and even before the arrival of the present-day Indians.

Since 1926, archaeologists had been finding evidence in western North America that Stone Age people once lived there. The evidence consisted of a peculiar kind of arrowhead, or rather dart-head, made of quartz and unlike any ever seen before. In contrast with the later Indian arrowheads these dart-heads had no notch at the base, but they did have a long groove down each side, and they were beautifully and delicately made. As the first ones were found near the little town of Folsom, New Mexico, they came to be called *Folsom points*, and soon archaeologists were speaking of the Stone Age people who had made them as *Folsom Man.*[*]

More Folsom points came to light. Implements of this sort were discovered in New Mexico, Texas, Nebraska, Colorado, Wyoming, Nevada, western Canada, and even Alaska. Furthermore, they were found in the same layers with the bones of an extinct kind of bison, larger than modern buffalo and quite different from them. Indeed, one point was found imbedded in the backbone of a bison—a bison that a prehistoric hunter probably killed to secure food and clothing. Clearly western North America had been the ancient hunting ground of a skillful and wide-ranging race of early Americans.

These discoveries led to all sorts of estimates of the time when the

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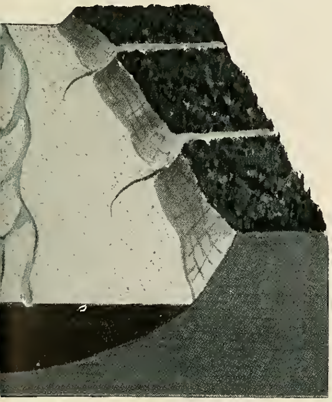
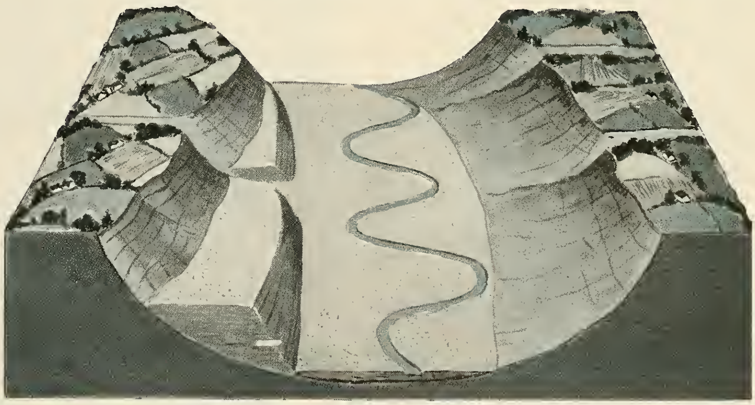
[*] See "The First Americans," by C. Bertrand Schultz, in NATURAL HISTORY for December, 1938.

ply. Scientists might never have
nd this log had the river not
nged from building to cutting



▼ TODAY, the river has cut down into the silt, leaving a terrace in the face of which the log was exposed. It was in this position that the geologists found it. The radiocarbon clock verified their deductions and gave it a definite date



Folsom people lived, but the estimates remained estimates — until radiocarbon came into the picture. A group of geologists and archaeologists in Texas, sensing at once that the radiocarbon calendar could solve the problem, searched for Folsom material suitable for laboratory use. At Lubbock, Texas, they found it: pieces of burned bone, the cold leftovers of a Folsom meal. Off went the collected and ticketed bones to the University of Chicago. There they were reduced to carbon, placed in the Geiger counter, and in due course the time since their animal possessors died was calculated. The radiocarbon date came out at 9883 years, with a possible error of less than 5 per cent.

Ten thousand years ago, then, in round numbers, Folsom people were living and hunting bison in North America. Ten thousand years ago was only a thousand years later than the time when the last big flow of glacier ice reached its outer limit at Milwaukee and Minneapolis and Yankton.

There is a good deal of evidence that the period when the Folsom people left their dart-heads and dinner scraps lying about was a period when western North America had more lakes, bigger streams, and therefore more rain than most of it has today. This is exactly what we should expect if most of Canada and part of the United States were covered with a thick ice sheet some millions of square miles in area. So the radiocarbon calendar shows that the evidence collected by geologists and archaeologists is consistent and illuminates another chapter in the ancient history of the continent.

With encouragement from the scientists at the University of Chicago, the complex laboratory equipment necessary for radiocarbon measurement is being set up at other research centers, among them Columbia and Yale universities. Radiocarbon dating is a slow, costly, and difficult operation, but the results it can bring to science may well become the twentieth century's greatest contribution to ancient history.

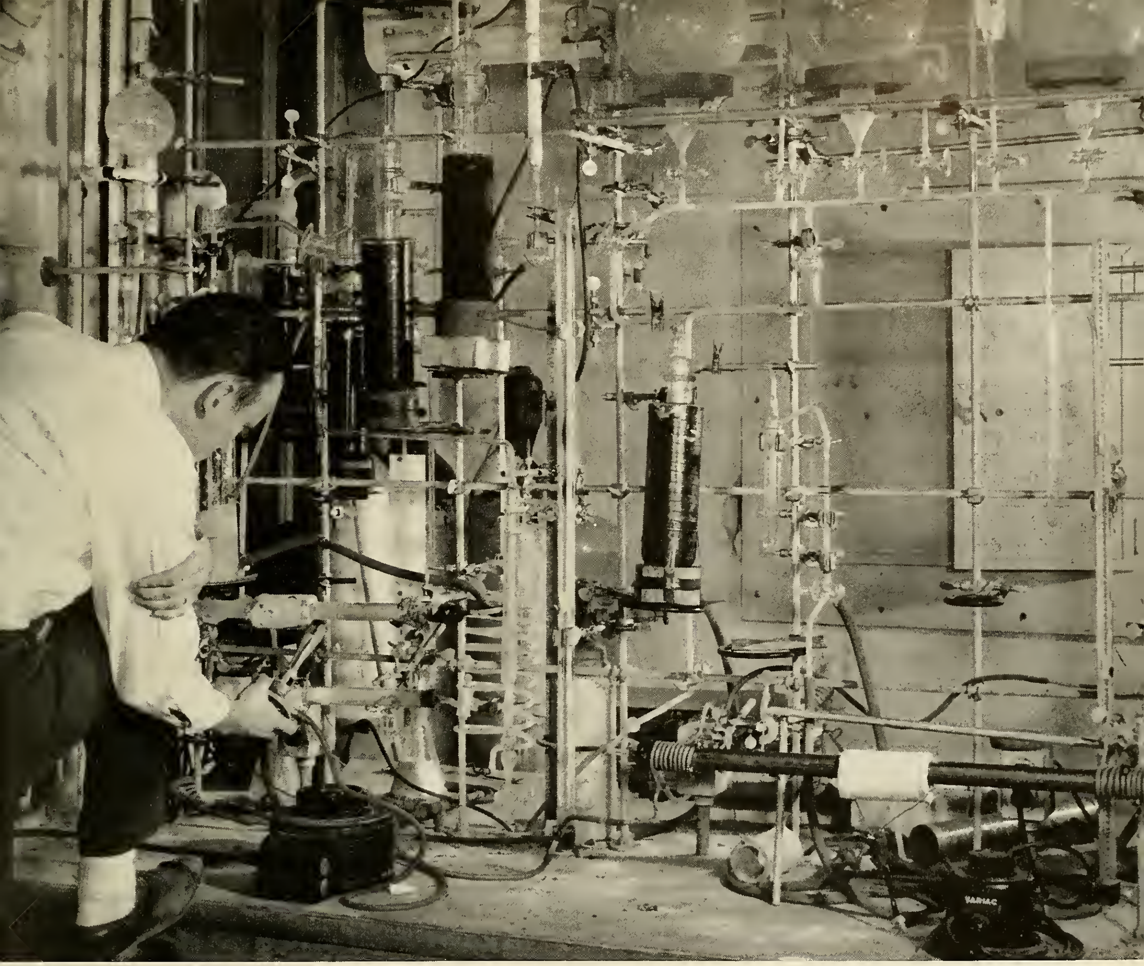
The COSMIC CLOCK - What Makes It Tick?

The instrument that tells the age of ancient samples fills all the popular requirements of a brain child of superscience, and it yields results that eclipse the promises of yesterday's visionaries

AMNH photos by Thane L. Bierwert

In the preceding article by Dr. Richard Foster Flint, the breathtaking implications of this new tool of science are dramatically discussed. Here the apparatus itself is depicted and explained for the first time in any popular magazine. The laboratories pictured are at the Lamont Geological Observatory, Columbia University, and are under the direction of Dr. J. Laurence Kulp, Geochemist.

Previously the antiquity of ancient bones, shells, and other organic matter—in other words, the very sinews of earth science—has



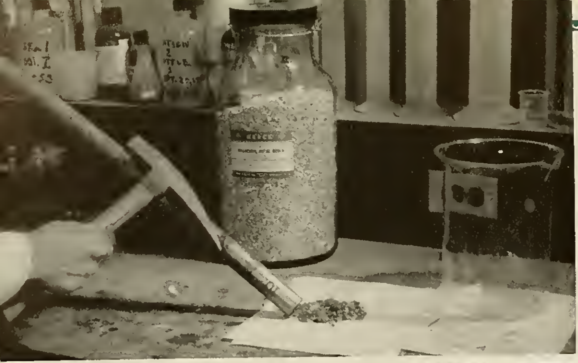
Dr. J. L. Kulp, of Columbia University, recording samples to tested at the University's laboratory at Palisades, New York. *ft to right:* clam shells that were buried by glacial mud; sea ter containing carbonate from two and a half miles deep; two ces of wood from a cave in southern Chile; a log from beneath bris of the mendenhall glacier in Alaska; and a whale vertebra und under twelve feet of volcanic ash in southeastern Alaska

▲ Igniting a wood sample. The carbon in the wood is converted to carbon dioxide, which is purified and stored in the large glass bulbs at upper right. The carbon dioxide is then brought down to the iron tubes at lower right, where it is reduced to elementary carbon by hot magnesium metal. By then, two days have elapsed since the beginning of the process. One trouble is that each test takes a long time. Also, the specimen is unavoidably destroyed

been at best an educated guess. For ages up to a few thousand years, estimates have been based on tree-ring studies and on seasonal changes in the thickness of sediments laid down by glacial rivers. Where methods like these failed, there has been no accurate chronology. So this is the first time it has been possible to date objects accurately up to 20,000 or 30,000 years.

The importance of this tool in terms of man's history during this time is hard to estimate. It probably presages the greatest single advance the science of archaeology has ever made. The information yielded by the Carbon 14 test is bound to revise many crucial dates in the complicated story of man's history.

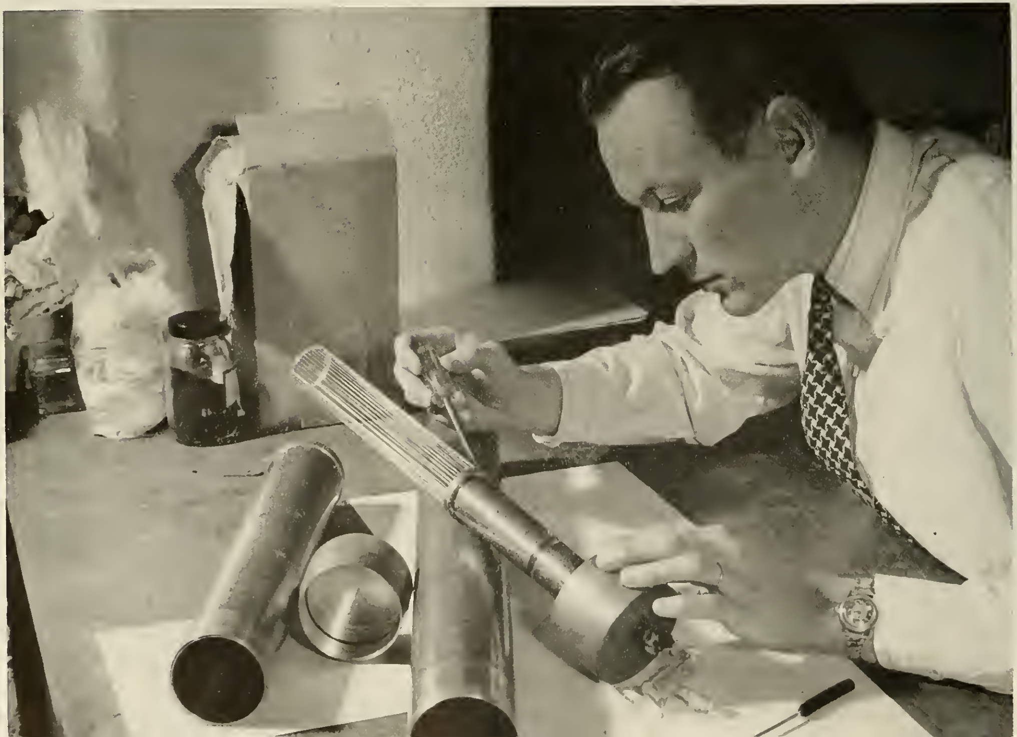
The peculiar radioactive species of carbon atom known as Carbon 14 is produced by cosmic rays in the upper atmosphere. It combines with oxygen to form carbon dioxide, which enters the tissues of plants and animals. The Carbon 14 atom differs from ordinary Carbon atoms (Carbon 12 and Carbon 13) only in that it is heavier and that it is radioactive. The radioactivity of Carbon 14 diminishes at a known rate. The instrument shown on these pages tells how much radioactivity is left in a given specimen, and this is a direct indication of its age.

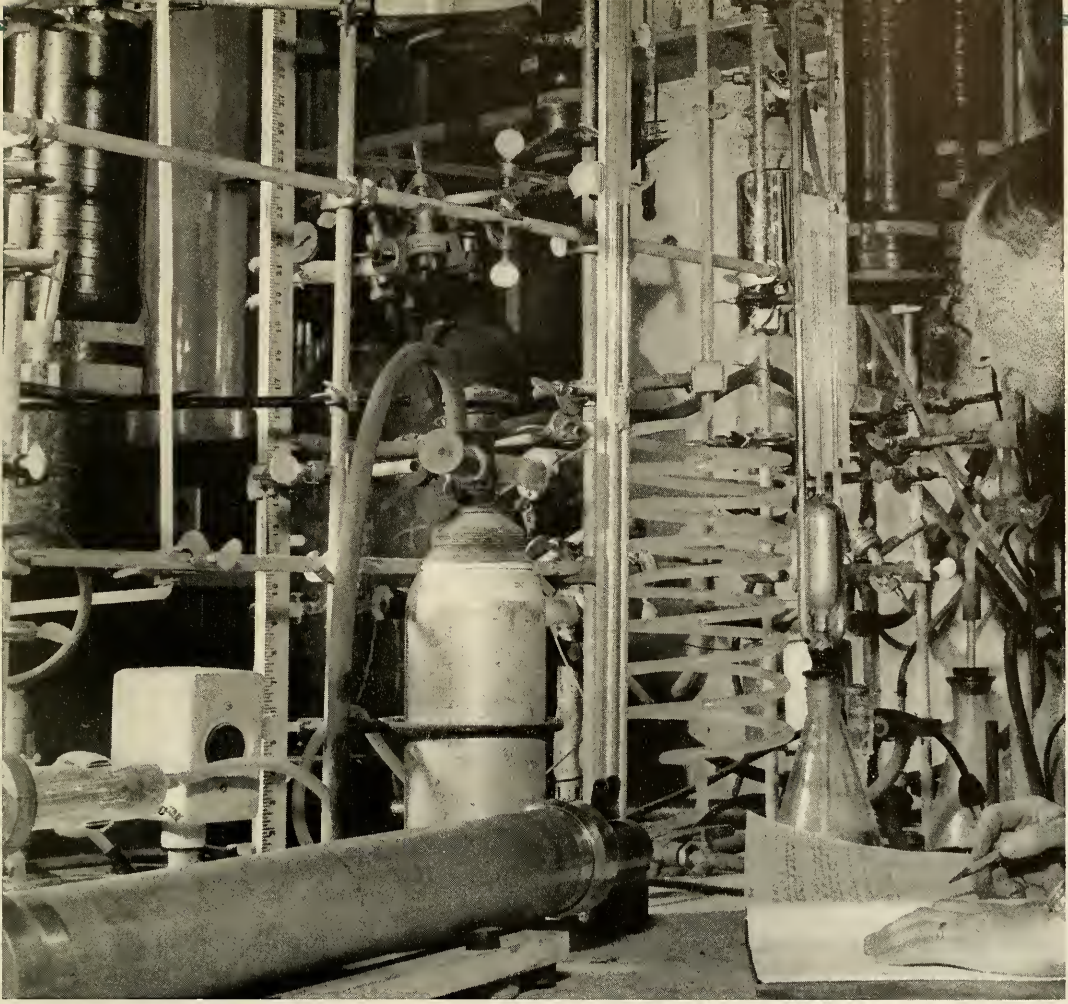


◄ Breaking the carbon out of the reduction tube. The carbon at this stage contains some magnesium metal and magnesium oxide, which are leached out by acid. The pure carbon is then dried and weighed

➤ The finely pulverized carbon is mixed with distilled water, and the paste is painted on the inside of one of the tubes. The other half, standing on the table in this photograph, is left clean to provide a "control" and is joined to the first. Dr. Kulp is here drying the carbon paste with an electric blower

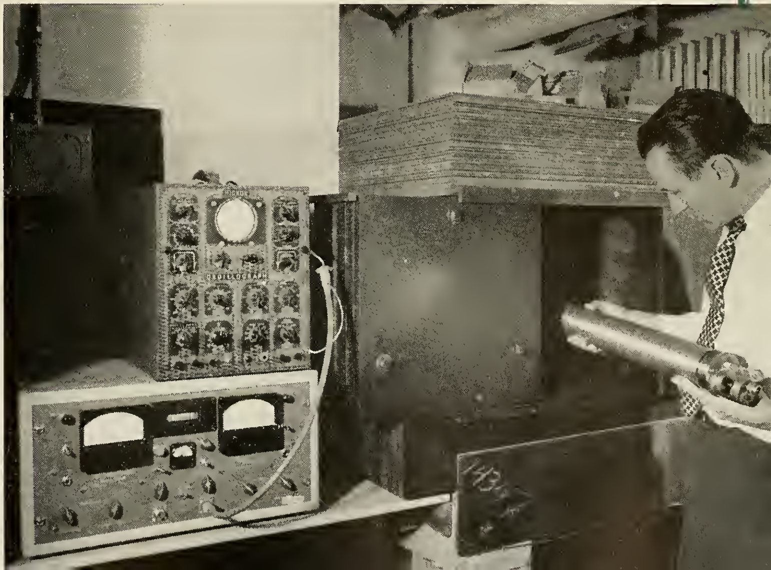
▼ The sample tube at left is inserted into the cylinder in the center, and the insides of the Geiger counter *(above it)* are put inside both. Most Geiger counters use only one wire. This one has 33 for greater sensitivity, connecting the base of the unit with a ring at the end. These wires draw in the beta particles emanating from the Carbon 14 sample





▲ THE AIR IS exhausted from the tube by high-vacuum pumping. The tube is then filled with a mixture of argon and ethylene and is ready for the counting

➤ PLACING THE GEIGER COUNTER containing the sample into the seventeen-ton chamber. The door weighs 600 pounds but rolls on steel cylinders at the touch of a finger. Heavy shielding is necessary to exclude the "soft" gamma rays, which would actuate the counter. Hard cosmic rays still penetrate the eight inches of iron, and these have to be filtered out electronically. The circular oscilloscope in the upper instrument shows both the hard and the beta rays. But the hard ones are filtered out so that the counter (between the two large dials) records only the beta rays. These tell the age of the sample

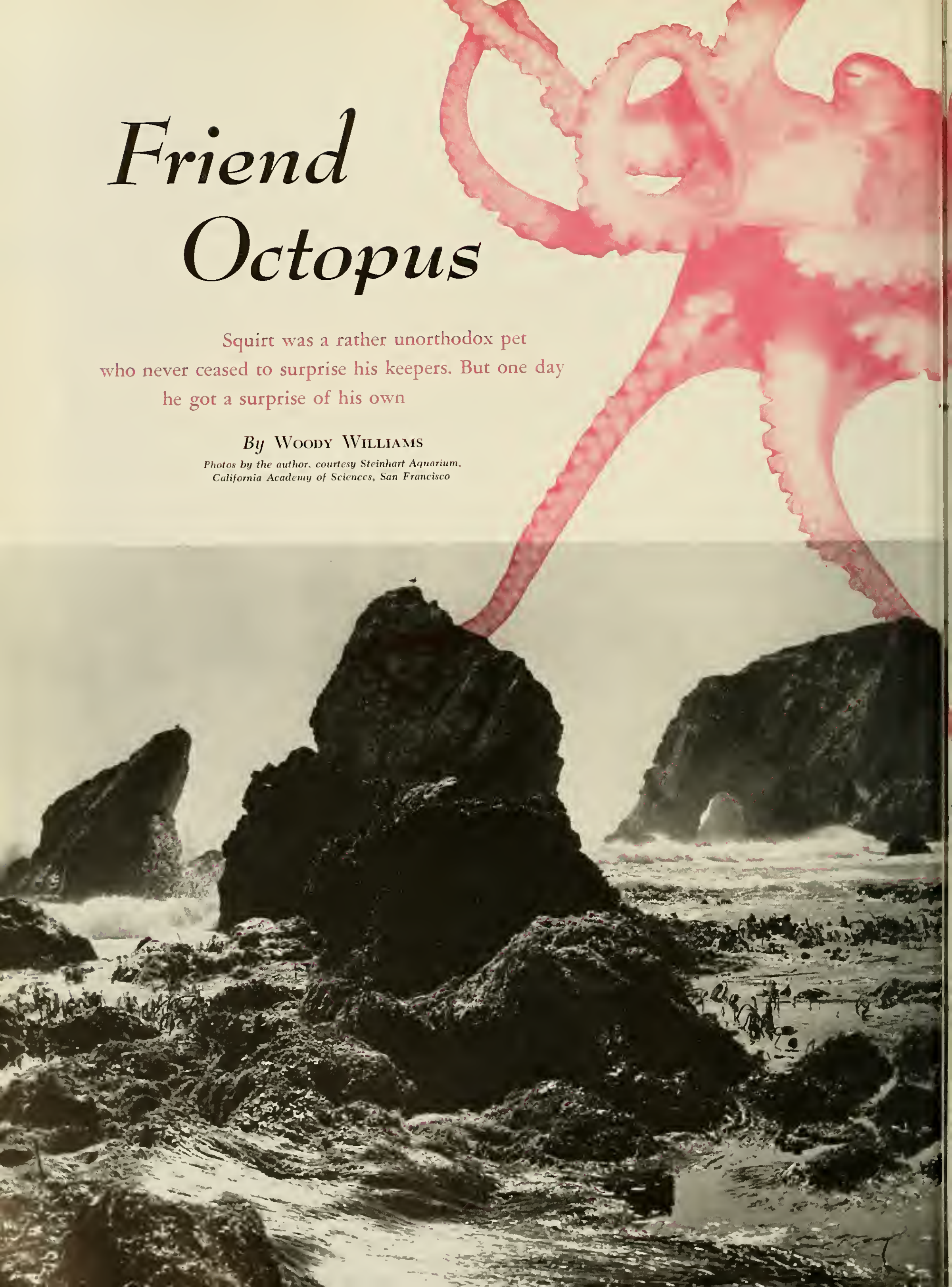


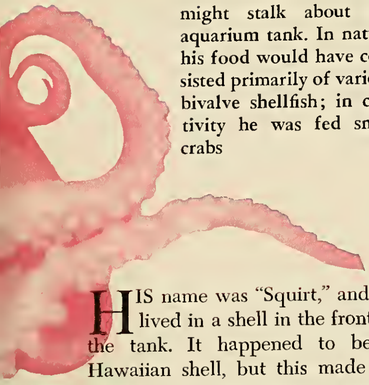
Friend Octopus

Squirt was a rather unorthodox pet who never ceased to surprise his keepers. But one day he got a surprise of his own

By Woody Williams

Photos by the author, courtesy Steinhart Aquarium, California Academy of Sciences, San Francisco





◂ WHEN HUNGRY, Squirt might stalk about the aquarium tank. In nature his food would have consisted primarily of various bivalve shellfish; in captivity he was fed small crabs

HIS name was "Squirt," and he lived in a shell in the front of the tank. It happened to be a Hawaiian shell, but this made no difference to the young octopus, despite his origin beneath an intertidal boulder in Southern California.

The name "Squirt" was almost the only one we could give him, for each move brought a squirt, each breath another. Sometimes it was a gentle squirt, to be sure, but at other moments it was a powerful stream as he dashed about the tank.

In the modern vernacular, he was jet-propelled – except that Squirt traveled in reverse gear. When excited, he would rocket up through the water, tentacles streaming behind. Then, suddenly, "bump"!– his rear end would smash into the aquarium, to remind him that he no longer had the freedom of the seas. At other times he would slither over the bottom, with the ends of his tentacles curling off the sand. Some kinds of octopuses are said to get up and toe dance on the tips of their arms, but Squirt didn't do this.

Perhaps you know that his jet apparatus, on the underside of his head, is called a funnel or siphon. It is generally used for excretion of waste products and water that has passed over the gills. When the animal swims, the funnel also produces a jet, pressure being built up for this purpose in the cavity beneath the mantle. Water enters the mantle cavity through another opening, which is then closed, and a strong muscular contraction of the body forces the water out through the funnel, causing the octopus to shoot backward. Squirt's relatives, the squid and cuttlefish, which have ten arms instead of eight, are even more adept at this method of getting about in the open sea.

Squirt's funnel also functioned in defensive tactics by laying down a smoke screen, whose dark brown coloring came from a so-called ink gland. G. E. MacGinitie, Director of the Kerchoff Marine Laboratory at Corona Del Mar, California, discovered that this smoke screen is not as simple as we might suppose. Besides offering concealment from the enemy, it destroys their olfactory powers. He found that the common shore octopus of Southern California, *Octopus bimaculatus* or *O. bimaculoides*, could paralyze the sense of smell of its major enemy, the moray eel, so that it required one to two hours in the laboratory for the eel to regain this sense. He noted that after an eel had been subjected to the ink, it would sometimes unwittingly nudge an octopus.

This ink is also a nuisance to people who attempt to keep creatures like Squirt in an aquarium. But we can say in its favor that it has left a permanent mark in man's culture, because the ink that comes from the ink sac of a cuttlefish is the source of the water-color sepia.

Still, I suppose Squirt had a right to show his temperament in an occasional blast of sepia, for he and his relatives boast the most highly developed nervous system of all invertebrates. He had, for example, a distinct brain protected by a cartilaginous case and connected with well-developed eyes. In fact, Squirt's sight was probably better than that of some vertebrates. Beneath the eyes were organs that were probably for smell, and buried in the brain case were two otoliths, or organs of balance.

The only degenerate portion of Squirt was his shell–just two internal vestigial chitinous rods. In the cuttlefish and squid the shell is more noticeable but not much more so. Probably the cuttlefish's shell, commonly called cuttlebone, is less important to the original owner than to caged canaries, who procure lime and salts from it. In the squid, the shell takes the form of a horny, pen-shaped structure. These "pens" are sometimes washed up on the beach.

Imbedded in Squirt's skin were remarkable pigment cells, which brought about a rippling change of simulative color over the creature's body as it moved from one habitat to another. Yet Squirt belonged to a species not as remarkable in this respect as some other octopuses. The octopuses and squids that have the best eyesight are also the ones that can change their color most rapidly and brilliantly.

S. Stillman Berry, authority on Pacific cephalopods, suggests that creatures of this group, especially those in the depths, probably possess the most highly developed luminescent organs in the animal kingdom. Squirt, though, knew several tricks never described in the literature.

For example, one corner of the tank was uncovered, and he would climb up there and blast jets of water out onto the floor. Sometimes the stream would run across the glass top of the aquarium and down the front. My boss would then blame me for not cleaning the front of the tank, which had become obscured by the occupant's mischievousness.

Squirt had another technique for public concealment that was extremely efficient. He would duck into the Hawaiian shell and turn it over on top of him. The sign on the tank read *"Octopus bimaculatus,"* which was certainly not the name of the dead Hawaiian shell left face down on display.

In nature, Squirt would have lived mostly on scallops, mussels, and clams, plus an occasional crustacean; in captivity he was fed small crabs. He would dash out from the shell, envelop one of them in the web of his tentacles, and then dismember the luckless crustacean in a leisurely manner,

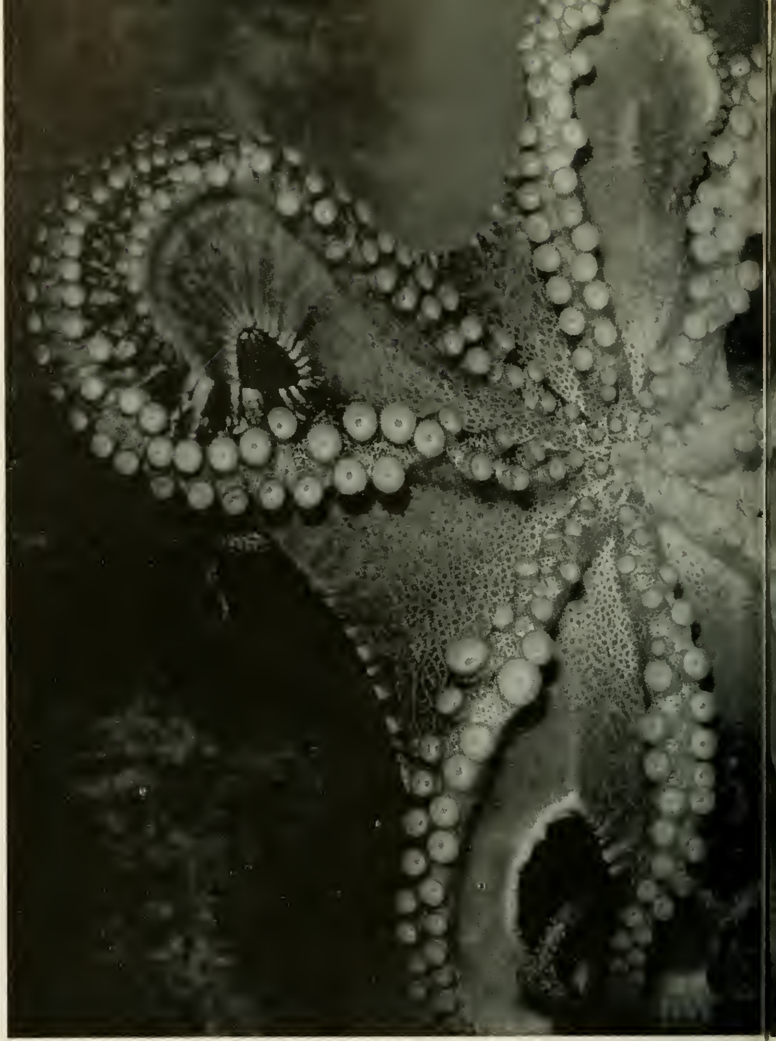
◂ OCTOPUS COUNTRY north of San Francisco, near Point Reyes in Marin County. Sometimes young specimens can be found by turning over rocks. Octopuses are popular food among California's Italians and Orientals like a tourist eating crab at San Francisco's Fisherman's Wharf. He would customarily crack the shell along the suture where it splits when the crab molts and then eat out the inside. He never crushed the shell as is sometimes supposed.

If you took the crab away from him soon after it had been captured, it would show no sign of bodily injury. It was just limp and dead. Squirt probably killed it with venom—not with his beak, which resembled a parrot's turned upside down. Squirt's relative, the common octopus (*Octopus apollyon*) of the coast of northern California, has been observed to spray its captive with venom. It didn't use its mouth for 20 minutes after the victim was dead.

In certain octopuses, this poison is toxic to man. In 1947, Don Simpson, collector for the Steinhart Aquarium in San Francisco, was bitten on the back of his hand while holding a specimen of *Octopus apollyon* for a photograph. The creature of one-foot spread left two small skin punctures on the back of the hand, which bled profusely. A few minutes later Simpson experienced a tingling sensation, and that night the hand swelled to obliterate the outline of his knuckles. Four weeks elapsed before the swelling disappeared.

In another authenticated case in Hawaii the venom produced dizziness in the victim, who had been fishing for octopuses on the coral reefs. He spent the most part of two days in bed, and there was some swelling and redness about the bite in the palm of his hand.

The kind of octopus Squirt was, however, has been found to be docile. G. E. MacGinitie tried time



▲ SQUIRT'S MOUTH can be seen at the center of the arms, where the tentacles converge. The octopus and its relatives have the most

▼ ORIGINALLY SQUIRT came from the waters at La Jolla, near San Diego. He was the common octopus of Southern California, *Octopus bimaculatus* or *O. bimaculoides*

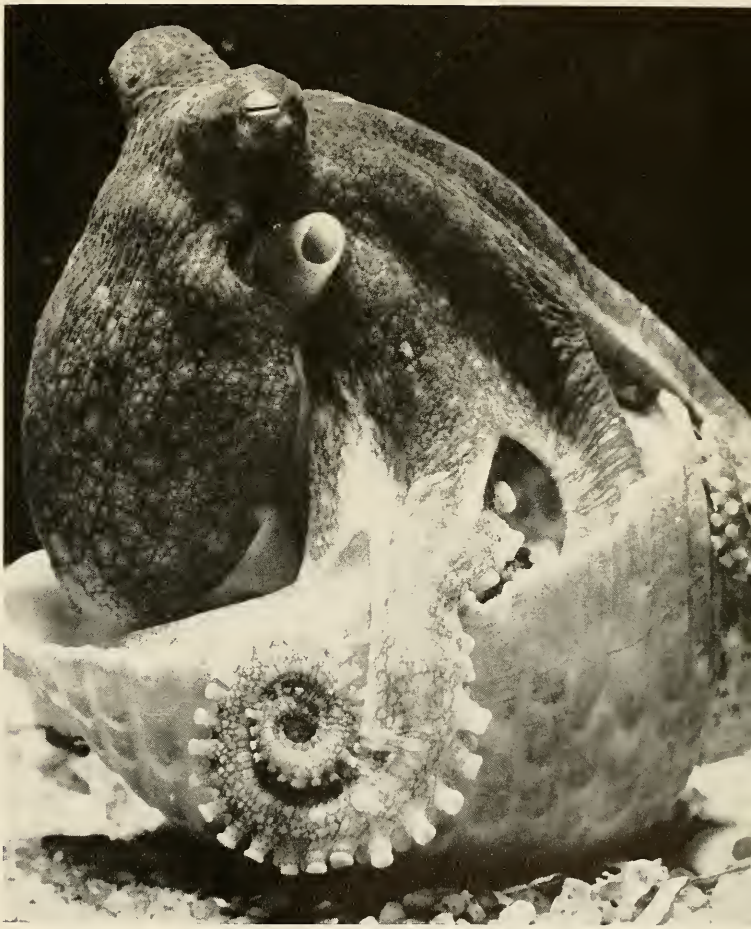
highly developed nervous system of all invertebrates, and they can probably see better than some animals with backbones

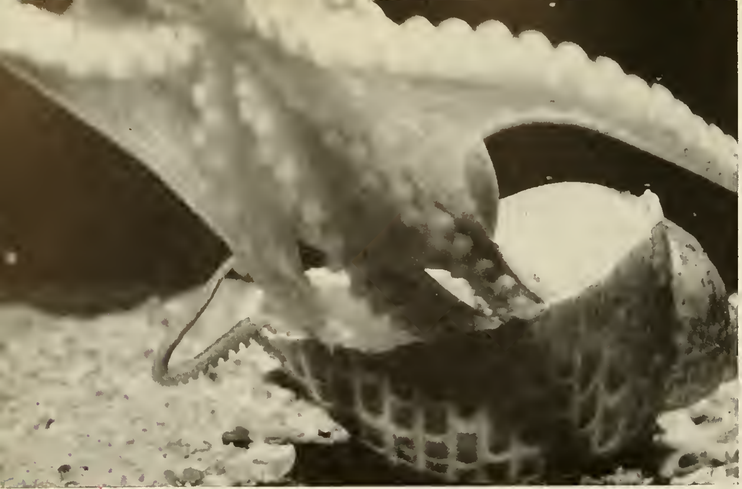
and again to get this species to bite him, but he never succeeded. Actually, for a very strange reason, we can't be absolutely sure he was working with the same species as Squirt. The prying curiosity of two biologists recently revealed a strange case of two distinct species of octopus that look exactly alike but live at different depths in the same area.

Adult specimens of what was then called *Octopus bimaculatus*, or the Two-spotted Octopus, were being studied at the Scripps Institution of Oceanography by Bayard H. McConnaughey. He thought they were all the same until he noticed that some of them were laying eighth-inch eggs (1.8-4.0 mm.), whereas the others were laying half-inch eggs (9.5-17.5 mm.). There were no intermediate sizes; a female either laid big eggs or small eggs.

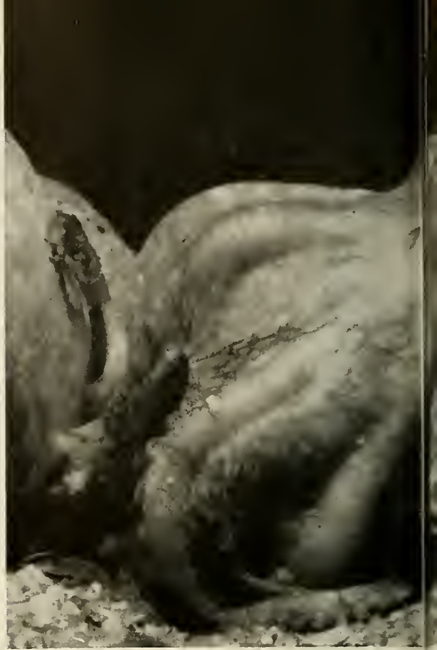
Grace Pickford of the Bingham Oceanographic Laboratory, who was collaborating in the study, then demonstrated that there actually were valid, small differences in the external anatomy of the big-egg and small-egg octopus but only in adults. Juveniles, like Squirt, were indistinguishable. And, to top the thing off, McConnaughey proved that different species of parasites called "mesozoans" inhabit the two different kinds of octopuses. So it is possible to tell whether a young octopus is one kind or the other. But because Squirt was very much a pet, we did not care to test this method by taking him apart to examine possible parasites. He may have been a large-egg octopus, which inhabits

▼ Squirt in his home—a Hawaiian shell at the bottom of the aquarium tank. With his funnel, which protrudes from under the mantle, he could eject a smoke screen or propel himself backward through the water

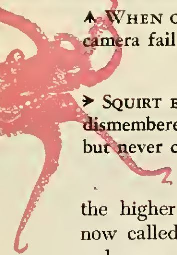




▲ **When offered a crab,** Squirt would shoot from his shell so fast that the camera failed to stop the action, even when set at high shutter speed



➤ **Squirt enveloped** the crab in the web of his tentacles and then leisurely dismembered it. He would customarily crack the shell to eat out the inside but never crushed it, as is sometimes supposed



the higher shore-line area and is now called *Octopus bimaculoides,* or he may have been the small-egg octopus, which lives in deeper water to an unknown distance offshore and retains the name *Octopus bimaculatus.* McConnaughey could not get the two species to interbreed, an additional evidence that they are genetically distinct beings. Probably the common name of Two-spotted Octopus will continue to be applied to both forms.

Squirt's sex was also a mystery. He may have been a she; but even in an adult Two-spotted Octopus, careful examination would have been necessary. The male uses one arm (the hectocotylus) to transfer a remarkable package of sperm, the spermatophore, to the female, where he usually places it under her mantle. Sometimes the tip of this arm is broken off and left with the female, the male being able to grow a new one. Observations indicate that Squirt's kind merely places the sperm under the female's mantle and then withdraws the entire arm. It is the third right one, and it looks like the others except for the minute and modified tip. This fact makes sexual identification difficult.

Maternal instinct is strong in the octopus. Dennis L. Fox, of the Scripps Institution of Oceanography, described a female Two-spotted Octopus that clung to her eggs even after the tank had been emptied of water. She remained in this position for fifteen or twenty minutes, resembling a "skinny-sac-like carcass." And W. K. Fisher, of the Hopkins Marine Station at Pacific Grove, observed *Octopus apollyon* to reject most of her food while brooding eggs from July through to October, which by then were only "dilapidated clusters of empty capsules."

Baby octopuses have to squirm their way out backward from the capsules, and W. K. Fisher, quoted in *Between Pacific Tides* by Ricketts and Calvin, tells us that "Once, in what might be interpreted as a flurry of temper at the difficulty of being born, one of the tiny animals discharged ink into the capsule."

Many sea serpent stories probably arose from the appearance of the tentacles of a giant squid swimming at the surface. The American naturalist A. E. Verrill reported that he measured a specimen from the North Atlantic that was 55 feet long and had arms 35 feet in length. MacGinitie estimated this creature to weigh 29¼ tons. Such arms, writhing along the surface, would undoubtedly produce a serpentine effect. A giant squid on the surface may not be a rare event. A tuna fisherman recently told me

◄ A WRESTLING MATCH ensues as Squirt drags the crab to his home. Cephalopods are preyed upon, in turn, by such creatures as the Moray Eel in Southern California and by the Sperm Whale, which feeds on giant squids in the deep sea

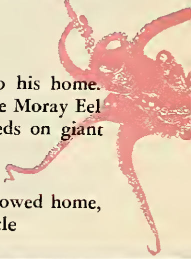
that he saw one of these monsters rise upward several feet above the water off the Coronado Islands near San Diego.

Verrill also mentioned the attack of one of these squids, *Architeuthis princeps,* upon two fishermen who came alongside to investigate a floating object in the water, which they thought to be a large sail or wreck off Saint John, New Brunswick. The account, an extract from a preacher's letter published in the Montreal *Gazette* about 1873, said, "On reaching it, one of the men struck it with his 'gaff,' when immediately it showed signs of life, reared a parrot-like beak, which they declare was 'as big as a six-gallon keg,' with which it struck the bottom of the boat violently. It then shot out from about its head two huge livid arms and began to twine them round the boat. One of the men seized a small ax and severed both arms as they lay over the gunwale of the boat; whereupon the fish moved off and ejected an immense amount of inky fluid that darkened the water for two or three hundred yards."

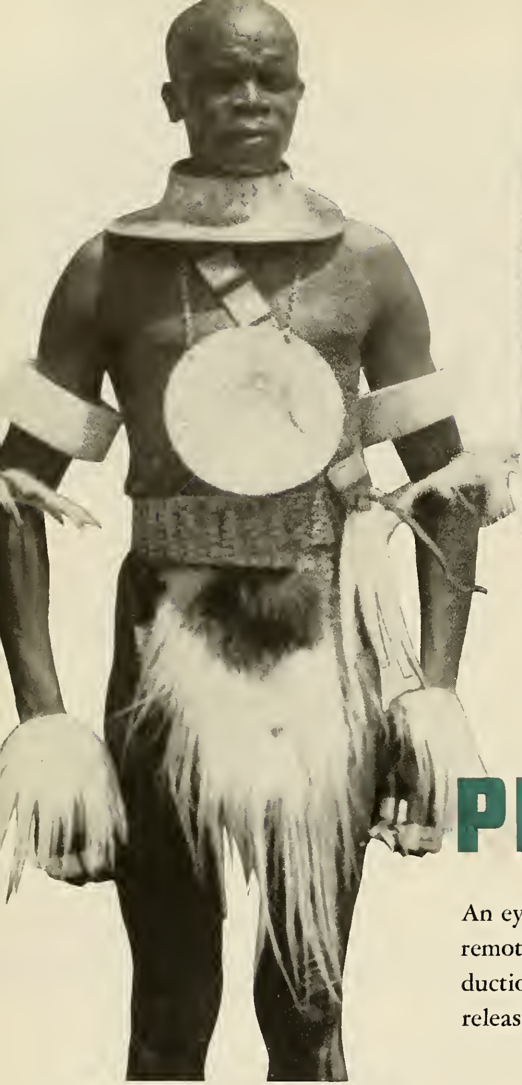
Evidence that these squids indulge in titanic deep-sea battles with the sperm whale, which feeds upon them, has been found on the bodies of captured whales. Marks of sucker discs as large as coffee cups, and large arms found in the stomachs of whales, indicate that even the marine giants live in constant conflict.

Yes, no creatures in the sea are stranger than the cephalopods. But like other groups, they also have their renegades or exceptions to the general rule, such as *Opisthoteuthis.* Not long ago this creature was taken off Eureka in northern California by the trawler "Andrew Jackson" in 188 fathoms. Beyond being new to science, which is not altogether uncommon for marine creatures, the animal had evolved in such a way that the funnel had been turned to point and discharge in a backward direction. This octopus was apparently jet-propelled forward instead of backward—unusual for an octopus, although squids can turn their funnel for propulsion in either direction.

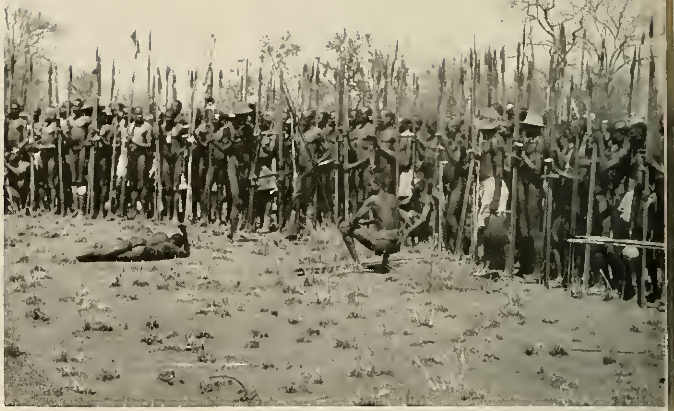
However, either direction was of little avail to Squirt one day when an overly enthusiastic gentleman poked his cane through the front glass of the tank. The octopus slid into the corridor of the Steinhart Aquarium amid an excited throng. There was considerable confusion, but the poor creature was finally recaptured, and he lived for some time in a repaired tank, jet-propelling himself backward as most of his ancestors have apparently done for a good many millions of years.



▼ WHEN SQUIRT RETIRED, he would ooze down into his borrowed home, but he always kept one eye alert through the loop of a tentacle



▲ A MALE DANCER, resplendent in ivory armlets and monkey fur



▲ MUCH OF their ceremonial life is directed toward success in food-procuring activities. Here the "Father of the Land" lies on the hunting ground before the spearmen and exhorts them to attack fearlessly and protect one another

We Saw PRIMEVAL MAN

An eyewitness account of the ceremonial life of Africa's remote Latuko tribe: vignettes procured during the production of a dramatic educational motion picture, whose release will be announced later in NATURAL HISTORY

By EDGAR MONSANTO QUEENY

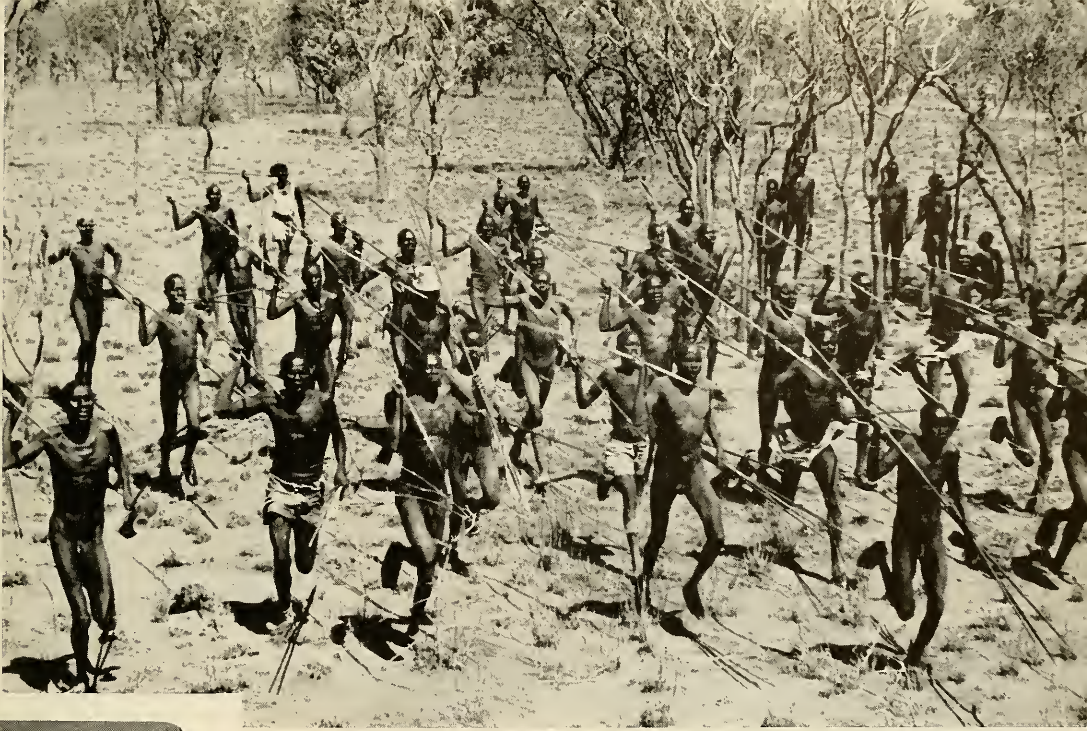
Trustee, The American Museum of Natural History

Photographs by Donald I. Ker

THE first white "men" to see the Latukos were a man and a *woman.* In 1863, that dauntless couple, Samuel and Florence Baker, spent several weeks at Tirangole—a Latuko tribal headquarters—while on the path to their historic discovery of Lake Albert. Fortunately, Samuel Baker was not only a great geographer and explorer but also a forceful author, who embellished his verbal descriptions with vivid sketches. His generous account of their stay at Tirangole permits the observation that little—very little—has changed during the 87 years that intervened before our visit. Hence, entering Tirangole was like raising the curtain on a play enacted by our own ancestors thousands of years ago. We looked upon primeval man—his industry, his witchery, and his violence.

Tirangole, which is but four degrees north of the equator, lies in the Sudanese province of Equatoria. It has a beautiful setting, nestling in a valley of flat open bush between the Imatong and Acholi mountains. Here, far away from our preoccupied world, both geographically and spiritually, dwell several thousand Latukos.

They are tall, well-formed people. The men's powerful Nilotic nakedness gleams under the torrid sun like polished bronze; the young girls, whose carriage and grace equal that of Powers models, wear



▲ **THE HUNTERS**, brandishing spears in mock attack, assure the "Father of the Land" of their courage

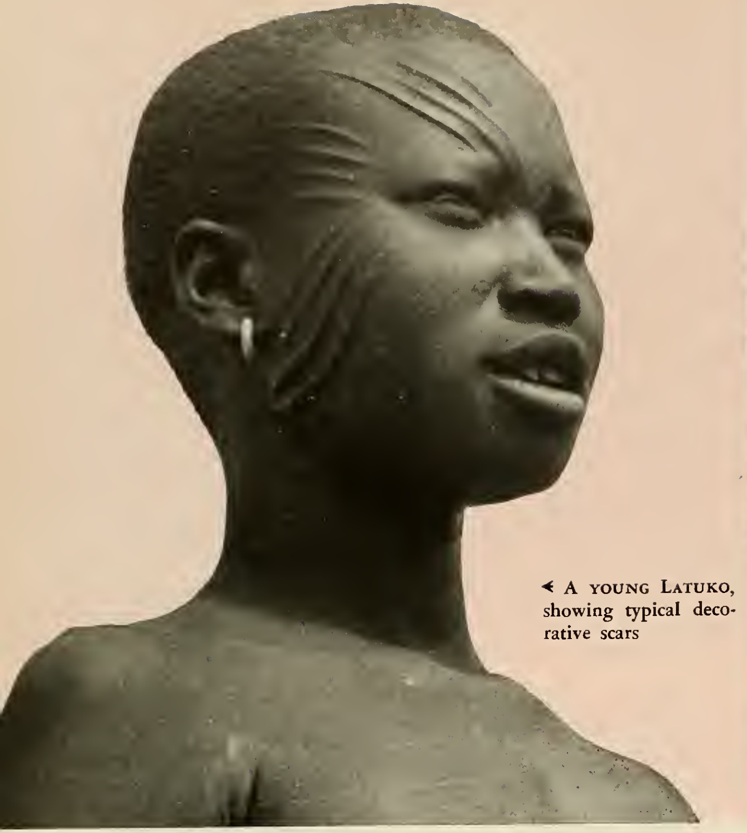
◀ **THE AUTHOR**, identifying himself as the leader of an American Museum expedition somewhere in Africa

only goatskin lappets, or aprons. Latukos are a courageous people, too. Their name was given them by the Anuaks, whose land they conquered. Latuko means "deaf men"; they did not understand when the Anuaks threatened. They are spearmen; their word for spear—*gor*—also means war. Until recently a Latuko boy was not considered a man until he had dyed his spear in an enemy's blood. Even today one seldom sees Latuko men outside villages without their spears. And in Tirangole one sees men with ornamental skin scars, or cicatrices, on their right shoulders, like lieutenants' bars, to indicate that they have killed *men;* such scars on left shoulders indicate that *women* were victims.

The spiritual and temporal head of a Latuko tribe is the *Kobu,* or Rainmaker. The office is hereditary and may be held by either man or woman. Tirangole's present Rainmaker—Lomiluk, a finely formed six-foot-four man—is the grandson of Moy, the reigning Rainmaker during Baker's visit. The British wisely administer the territory through Lomiluk.

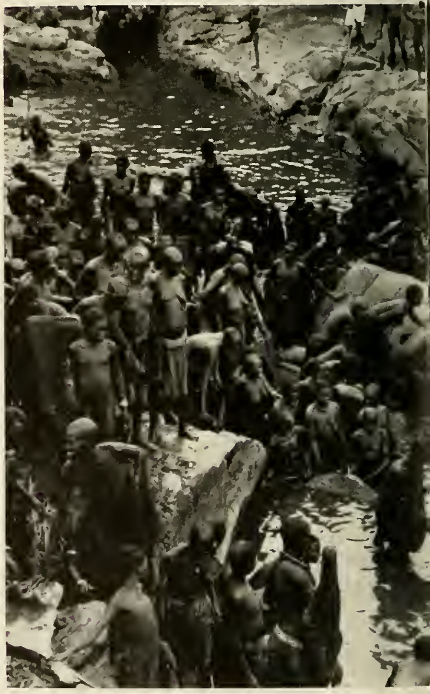
Torit, some 30 miles distant, is the residence of the British District Commissioner, Mr. John Owen, and a headquarters of Equatoria's Defense Force. Although Christian missionaries have made some headway here, the Tirangole population is almost entirely pagan. It consists of members of the Iago clan. Their totem animal is the crocodile; they believe that after death the departed soul enters a crocodile's body. In addition to the beliefs surrounding the totem, Latuko spiritual life centers about rites, magic, and dancing, having to do chiefly with their food supply—their grain and their game. For instance, magico-religious rites precede their hunts.

Dry season is hunting season. Equatoria's annual rainfall averages some 36 inches, almost all of it falling between the spring and fall equinoxes. October through February, when the sun is over the Southern Hemisphere, constitutes the dry season, at the end of which all small rivers have vanished, the soil is cracked and parched, and its surface is a powder frequently swirled up to the heavens by gyrating dust devils. The grass is burned off, and from November through early



◂ A YOUNG LATUKO, showing typical decorative scars

▴ THIRTY MILES beyond the administrative headquarters of the district, the expedition reached Tirangole, a settlement practically isolated from the rest



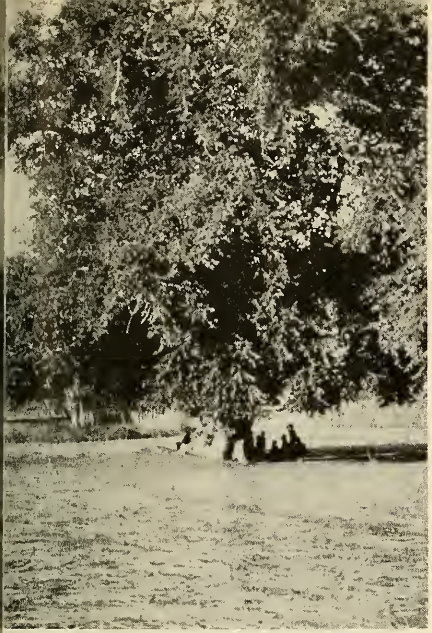
▴ WOMEN FISHING. The fish were driven from far down the river and

March game is given little peace.

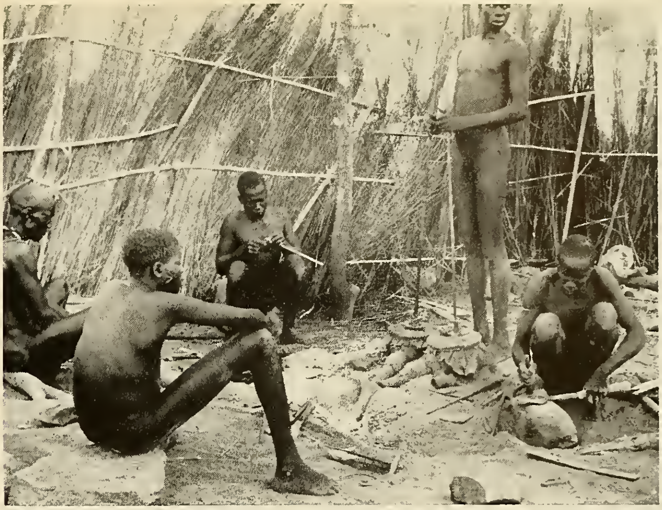
Often men hunt in small parties, but the hunts at large centers like Torit and Tirangole are weekly affairs with several hundred participants.

The *Lamonyremiyi*, or "Father of the Land," is a hereditary office which exerts real power in Latuko spiritual affairs. In Torit the office is now held by a woman, Abolo'ne. Before the hunt commences, she ensures good fortune by mixing charcoal and earth, spitting upon the mixture, and scattering it at the feet of the huntsmen while uttering an incantation. As Abolo'ne is too aged to go to the hunting field, her son, who will succeed her as "Father of the Land," completes the rite by lying on the hunting ground before the surrounding spearmen and exhorting them not to run from lion and buffalo but to attack them and protect each other. The hunters reply singly and in groups by running past him, brandishing spears in mock attack to assure him of their courage.

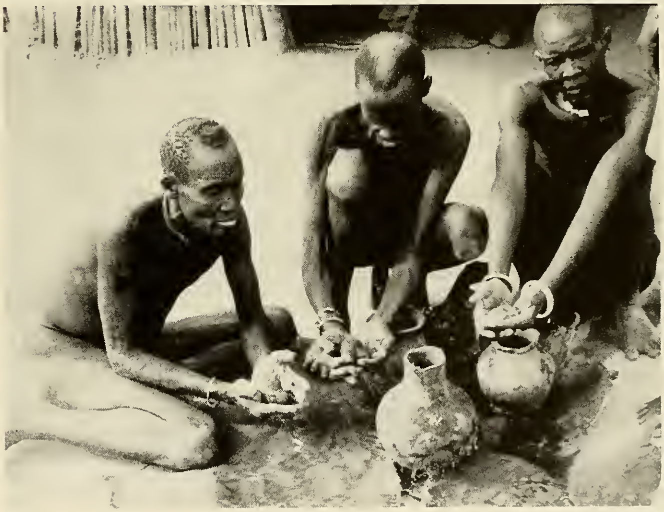
All spearmen then separate into two groups, each man carrying three or four spears. Some wear straw hats woven from local grasses, usually their only clothing; others carry diminutive stools on which to sit during any halt in the hunt. The stools are solid, having been carved from a single piece of wood. At the commencement of the hunt, two "horns," each consisting of a file of some 200 men, go out, one obliquely to the right, the other to the left. Discipline is excellent. Each "horn" spreads out to become a semicircle of three or four miles of evenly spaced men. When the leading men



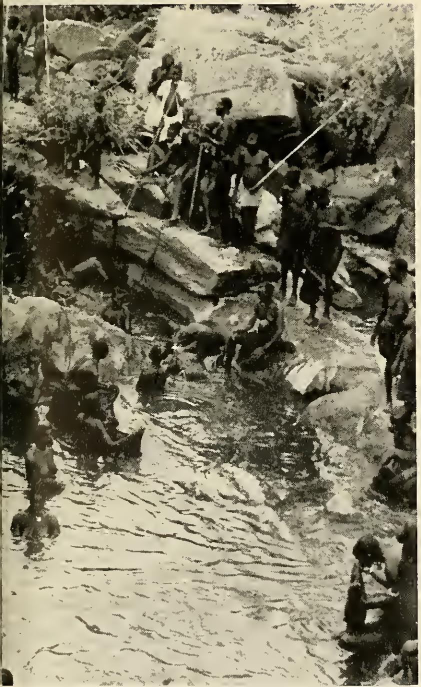
of the world. In 1863, Samuel and Florence Baker, the first white people to see the Latukos, are said to have camped under this very tree



▲ Iron-working techniques have not changed here since the Bakers first observed them almost a century ago. A drawing almost identical with this photograph was published in their book



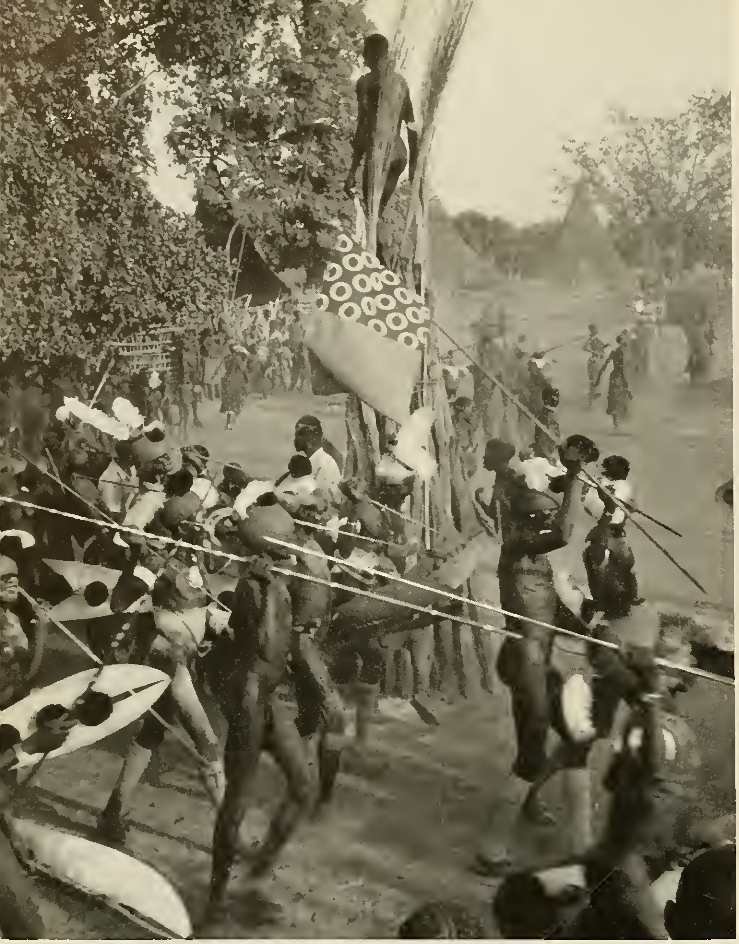
▲ Among the tribe's most sacred objects are the rain stones—vital properties in the annual rain-making ceremony. Few white people had ever witnessed this rite. The motion picture taken by this expedition and soon to be released is the first of its kind ever secured



caught in woven nets—amid screams reminiscent of a girls' cheering section

meet, all game within five to ten square miles has been encircled. The men then close slowly toward the center. All game trying to break out of the circle is their quarry; nothing is spared intentionally.

In the company of Mr. John Owen, the amiable and highly efficient District Commissioner of Torit, we witnessed three of these hunts. Most of the bags consisted of small stuff—oribi, kongoni, bushbuck, waterbuck, wart hog, hartebeest, lesser kudu, even guinea fowl—but we were in on the kill of one *na'swan*, a buffalo, which had enough spears bristling out of him to give the appearance of a pincushion. Other buffalo, however, broke through. When we noticed a



◄ THE DANCE celebrating the beginning of a new crop year: a stirring display of primitive pageantry

man failing to throw his spears at one of them, Owen remarked that the village women would sing of his cowardice for years. Several giraffes also broke through amid showers of spears, as did a rhino and calf.

Buffaloes are the most frequent big game to fall, and they usually even the score before succumbing. But leopards and lions are not infrequent, and occasionally an elephant is bagged, too. A small strip of the hide or hair from such big game is fastened to the ceremonial spear of the victorious hunter and is carried to dances. We saw many of them. It takes courage to work through shoulder-high grass, not knowing what it may conceal; but none of the hunters shirked such cover—and many were rewarded with game.

Fish are the women's quarry, and as in the hunting, hundreds of this gregarious tribe participate. In some villages the *Lamonyekhari*—"Father of the River"—sacrifices a black or red goat on the bank and throws its stomach contents into the water to propitiate crocodiles. At Torit, however, this rite is not observed.

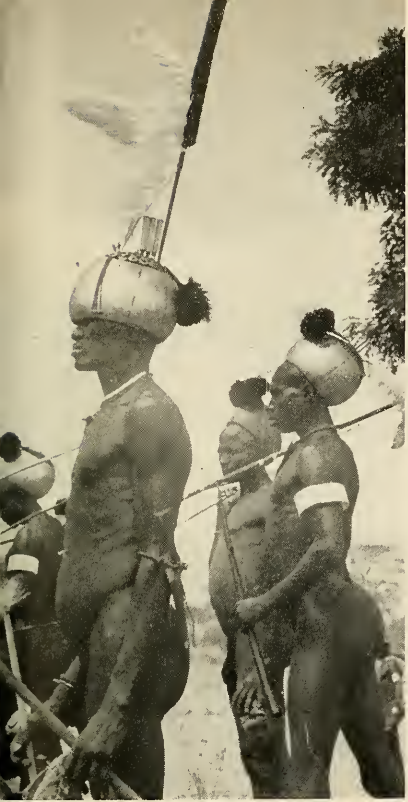
Girls and women of all ages gathered on the bank of the river. Each had a large leaf-fiber net bag of *sansevieria* (wild sisal) tied to her waist to put the fish into, while her arms wound about another net of the same fiber, which was for scooping up the fish. As the fishing commenced, 50 or so arranged themselves across the river to form a barrier. The remainder, starting a mile or more downstream, slowly waded en masse toward the barrier, driving the fish ahead. The older women squatted and searched the river bottom with their nets, while the young girls dove and pushed their nets along the bottom. The din sounded like the women's section of the grandstand at a ball park. Each screamed in excitement when a fish was caught in her net; others acknowledged in chorus. After an hour the two groups closed, laughing and shrieking, in a wild scramble for the trapped fish. Their haul was considerable, including many three-footers resembling catfish.

But the great magico-religious rite of Latuko life is the March rainmaking, which precedes the readying of land for millet planting. It entails hazards for the Rainmaker, too, as some Nilotic tribes have murdered their Rainmakers when prolonged droughts followed the rites. Mr. Owen persuaded a reluctant Lomiluk to reperform the rite for our cameras and sound recorders. As a reward I promised him my wrist watch, which he had admired.

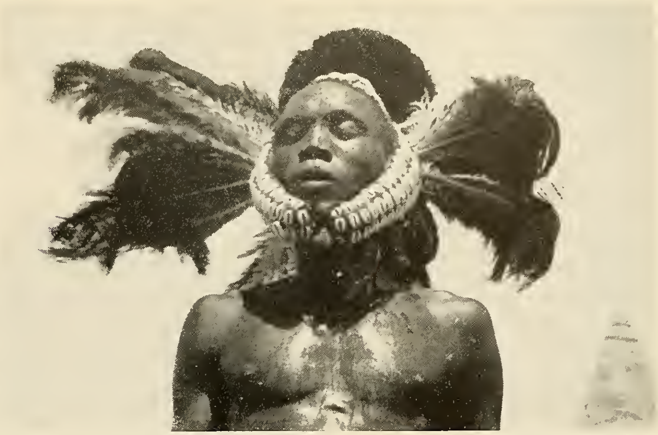
Hence one afternoon we were permitted to bring our apparatus into their holy of holies—the rain shrine enclosure. The rain shrine is the largest and tallest hut in Tirangole. In one corner of the ironwood palisade that encloses the village are five large clay pots each containing the bones of a departed Rainmaker. One has those of Moy, Baker's friend, another those of Lokidi, Lomiluk's father, who was killed in an intertribal battle in 1917.

While we were readying our cameras and microphones, one of our party rested the "clapstick," which we used to synchronize our sound and pictures, on one of these urns. Immediately ominous words and gestures issued from bystanders; the offending article was removed hastily!

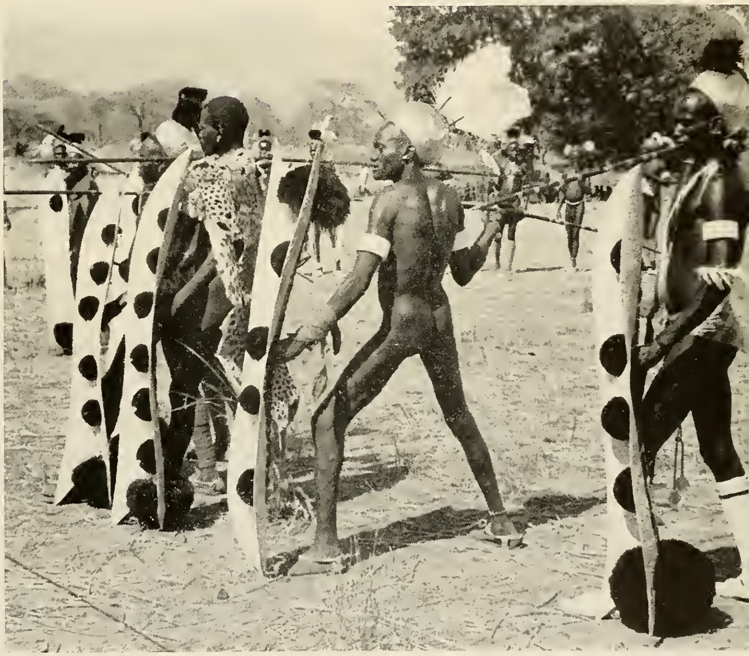
Kobu Lomiluk, who wore shorts belonging to the uniform provided



▲ THE HELMETS were of matted human hair covered with brass hammered from cartridge cases. Note the ostrich plumes and (on the nearest figure) the dark four-foot spike wound with the nuptial ruffs of 400 biship birds



▲ ANOTHER TYPE of Latuko headdress



▲ SPEARMEN in full ceremonial regalia, including buffalo-hide shields adorned with ostrich-feather pompons

him by the British, and three *Abalokos*—acolytes in native undress—arranged themselves before the rain shrine. Beside them stood a small black goat; it is necessary that the sacrificial goat be black. After some incantations, two *Abalokos* seized the goat and quickly strangled it. At this point Lomiluk's aunt came forth from the shrine with a half gourd of *mirissa*—millet beer—into which two *Abalokos* spat. Beer and earth were mixed with the contents of the goat's stomach, which were then carried into the rain shrine and rubbed on the holy rain stones, while the *Kobu* drank the holy beer. After five minutes, the *Kobu* and one *Abaloko* carried double handfuls of stomach contents to the urns, threw it upon them vigorously, rubbed the urns, and uttered a long incantation. The heavens having been thus propitiated, the ceremony was concluded.

Later the *Abalokos* brought the sacred rain stones out of the shrine for our inspection. As these stones symbolize solidified rain, they were handled with considerable reverence and were placed on a cowskin while we examined them. Each was a quartz stone slightly larger than a golf ball and rested in a musty clay pot.

During the ceremony, Lomiluk was a fine figure. Typical of his tribe, he was tall, erect, and finely proportioned. From his wide, muscled shoulders, his form tapered to well-developed thighs, with hips almost unnoticeable. Like all Latukos, his two lower incisors were missing; tribal custom requires them to be gouged out as soon as the permanent teeth have grown. His head was shaved, and typical decorative scars on his face and chest enhanced his austere bearing.

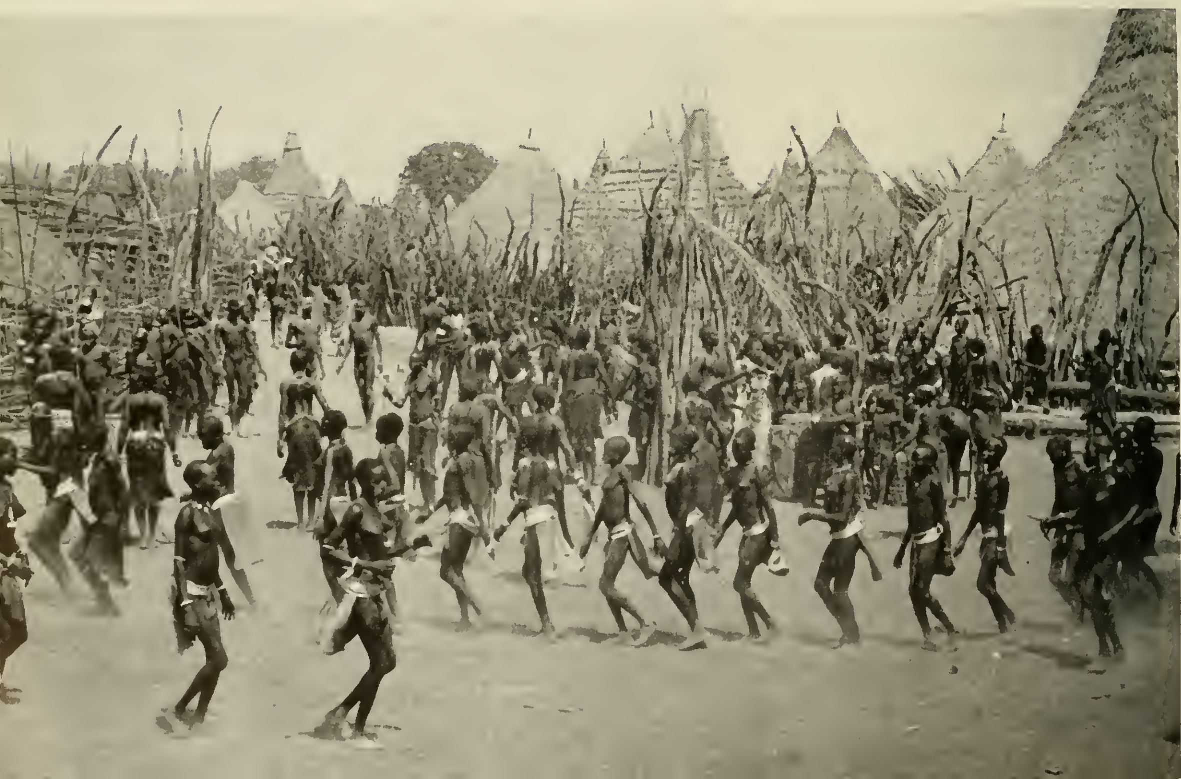
We were told that very few white men had witnessed this rite. Authoritative ethnological books admittedly describe it by hearsay. Certainly our sound and photographic records are firsts. Incidentally, the rite was extremely effective: it poured the following day!

As the true rainmaking had taken place before our arrival, we were fortunately able to witness the *Na'lam*—a dance celebrating the beginning of a new crop year. It was a colorful, spectacular, dusty, and noisy affair. At noon of the first day of *Na'lam*, men gathered some two miles from the village for pre-dance festivities. The Rainmaker had slaughtered, or "sacrificed," three oxen by the simple expedient of having them bulldogged in cowboy fashion, then hitting their heads with an ax. If, as we were informed, this constituted a sacrifice, it was also eminently practical, for fires were built immediately and the meat was cut and roasted.

Warriors arrived at the scene of the "sacrifice" in parties averaging 20 or so, yelling like Indians and brandishing spears. Each group dogtrotted around the ground, stopping occasionally with spears poised in a mock attack on an imaginary enemy, and then retired to the shade of trees to feast and watch the performances of succeeding parties. Costumes varied. Some wore red helmets of matted human hair, from which ostrich plumes protruded; others had similar hair helmets covered with brass made from cartridge cases and topped by four-foot spikes, around which were beautifully wound the nuptial ruffs of male Bishop weaverbirds. Approximately 400 red-and-black ruffs adorned each spike. Several groups carried white buffalo-hide shields, each dotted with five large black ostrich-feather pompons. Divergent tastes expressed themselves in skin embellishments. Some were smeared gray with dung ash; some torsos were covered with red ochre designs; a few faces were streaked blue. Some heads were clean-shaven, others were shaved into patterns—coxcomb, topknots, or polka dots, looking as though sticky black peppercorns had been sprinkled on them. All wore beads galore and ivory armlets—cross sections of the bases of elephant tusks.

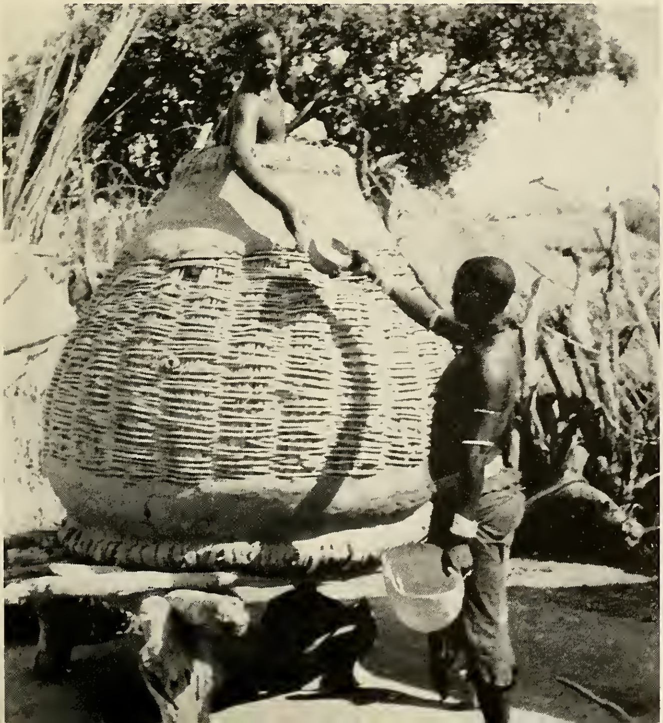
From the village streamed a steady procession of women balancing on their heads gourds filled with *mirissa* for their men's libation. *Mirissa* is the fermentation product of millet; it is pink and frothy.

➤ **Drums** of different pitch boomed a greeting as the villagers approached the ceremonial ground



⮟ **Dance of the Virgins.** The participating maidens wore iron-mail aprons made of small chains, with cloth in the rear

About four o'clock in the afternoon both men and women danced en masse to Tirangole. Drums, arranged alongside a tall pile of ebony and ironwood in the center of the village commons, boomed a greeting. Immediately after the group arrived, the dance began. There was little semblance of order. The dust rose in heavy clouds and, as the tempo of the dance increased, covered the entire village with a suffocating fog. Dancers could scarcely see one another, but their exuberance remained undampened. Occasionally one woman would throw handfuls of millet into the melee; undoubtedly this had symbolic meaning. At times the Rainmaker himself drummed, two men holding a rattan awning over him to ward off the sun's rays.



▼ THE GREAT CEREMONY is to ensure a bountiful crop of millet, which is stored in huge containers like this

At sundown we departed for our camp. Tirangole could be marked from afar by what appeared to be a rising column of smoke from a gigantic fire. It was dust! The dance continued all that night and throughout the following day; dancing alternated with resting and *mirissa.* Certainly the success of their crop must have been assured!

But this sketchy account is only an introduction to some elements of Latuko life. Here is a people for whom nature supplies all material wants, while magic ministers to their spirits. They are as content as it is human to be—even as our European ancestors were a hundred centuries ago.

How long will the primeval last in Tirangole? How long will it remain unchanged? The British intend to withdraw from the Sudan in the comparatively near future. If this eventuates and the Sudanese attempt to rule themselves—or, as seems more likely, if they are governed by the Egyptians—changes will come slowly if at all. Even if the British remain, change will come about much more slowly than in more accessible parts of Africa. It takes two weeks to ship cargo up the Nile from Khartoum to Juba, then a day's journey by road to Tirangole. Six months' rain and six months' drought are not conducive to profitable agriculture, and the rolling terrain makes irrigation impossible. The climate is inhospitable; virulent diseases are prevalent. It was not until the end of World War II and the advent of ultramodern medicine that British officials were permitted to bring their families into Equatoria. So perhaps our Latukos are safe, for a time at least, from the stress and atomic fever of "civilization." If so, may their Rainmakers be attended by the same success as *Kobu* Lomiluk was in March, 1950.

BOOGUM—
Desert Contortionist

A plant individualist of Lower California that can't be accused of making the landscape look ordinary

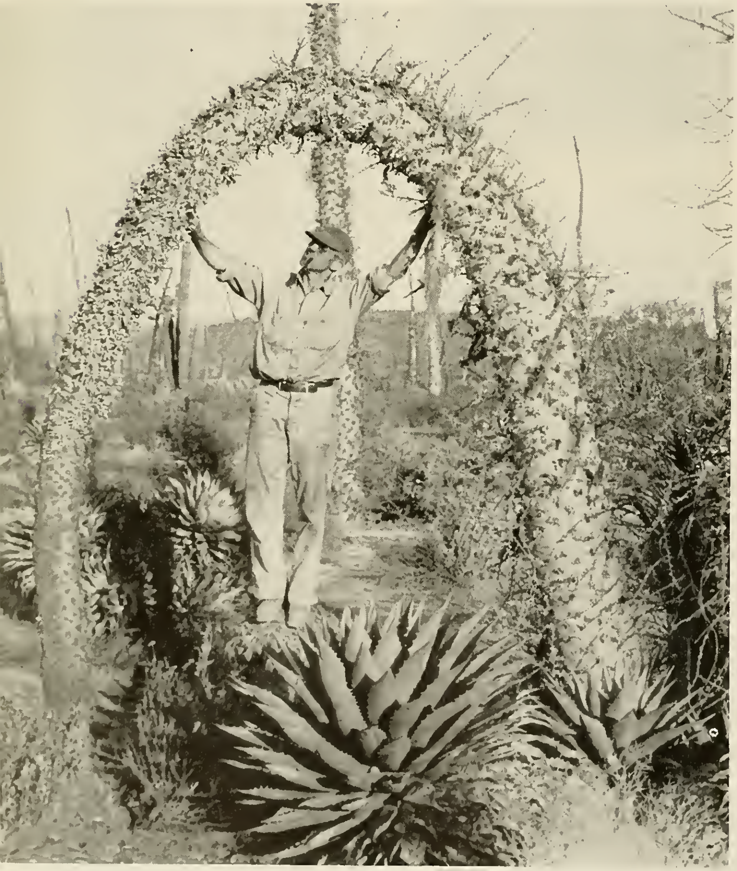
By Lewis Wayne Walker

Photos by the author

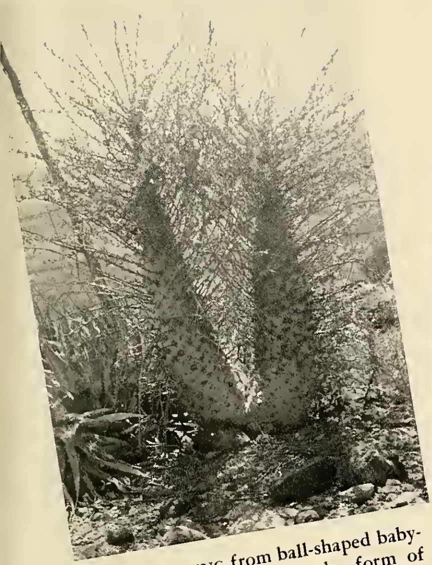
THE road that penetrates the peninsula of Baja California is bumpy, and on reaching Hamilton Ranch, the last outpost for tourists, it resembles two cow trails that sometimes run a parallel course. Ten miles an hour becomes an exhilerating speed, a pleasant respite from the low-gear grindings in the deep arroyos. To the right, rocky points jut out into the Pacific; to the left, rolling hills rise to a plateau that saddles the central part of this seldom-visited area. Two hundred and fifty miles south of the border the trail gradually swings to the east, and hours later, with the Pacific far to the rear, it enters the weird forests of Boogum or Cirios—a region where the outlandish becomes commonplace and where strange silhouettes and botanical contortionists encircle the dusty traveler.

Many of these cirios rise straight into the air and end with a burst of small blooms on the crown fully 50 feet above. These tall, rigid spikes are, no doubt, the normals, but in every group that adheres to the straight and narrow there are a few that seem to have lost all sense of direction, and instead of reaching for the sky they throw crazy loops supinely along the desert sands. Others start growth in a conservative way and then gradually arch in a downward circle, finally burying their heads in the ground and taking root at both ends.

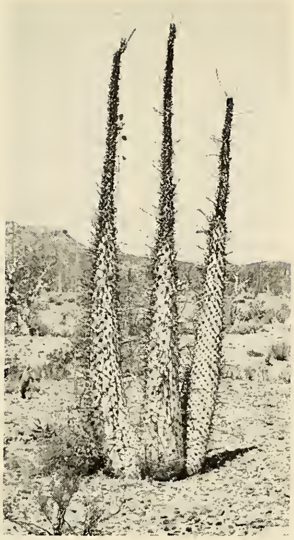
As saplings, cirios look like balls almost as wide as they are high, protected from grazing animals with numerous rigidly-spined twigs protruding from the grayish bark. These twigs show a distant relationship to the more familiar desert ocotilla, but from there on, close similarity to any other plant seems to vanish. As the young plant grows,



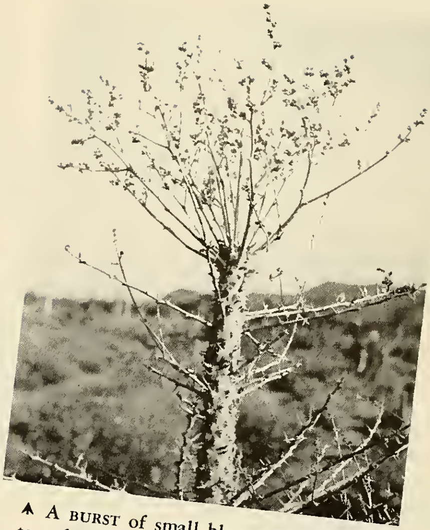
◄ Having buried its head in the sand, this boogum has outdone the fabled ostrich and literally rooted itself at both ends



▲ GRADUATING from ball-shaped babyhood, the boogum takes the form of an inverted ice cream cone for a time

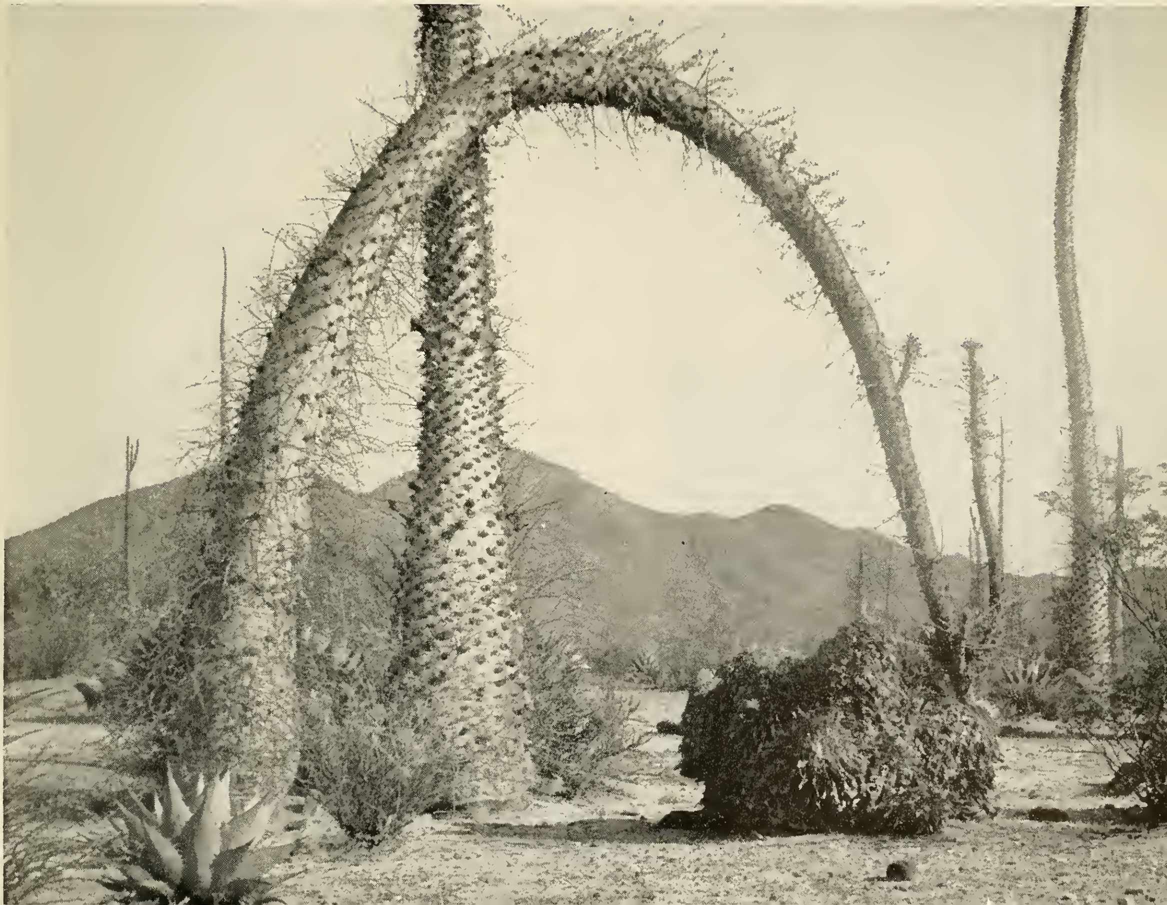


▲ ABOUT one-fourth grown: a homely trio in a barren homeland



▲ A BURST of small blooms enlivens the top of the boogum spire

▼ SOME grow this-a-way, and some grow that-a-way



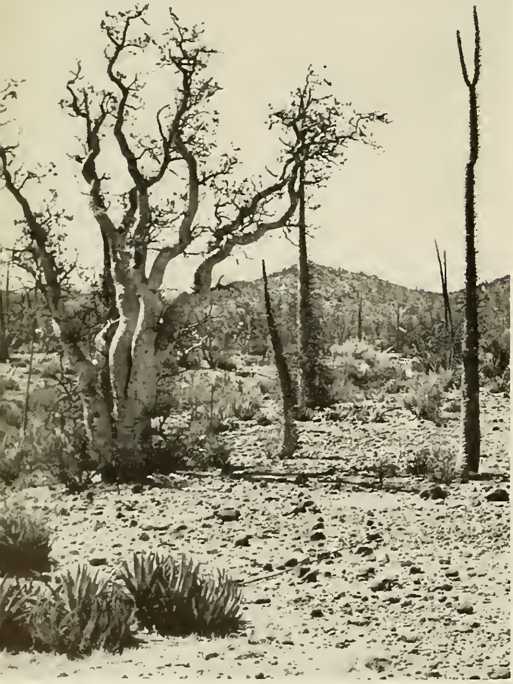
rapidly in wet seasons but practically not at all in dry, the armored ball gradually starts to elongate and tapers to a point at the top. During this vertical development, it also spreads at the base until the whole plant, on reaching a yard in height, resembles an upside-down ice cream cone.

Just below the surface of the ground, horizontal roots radiate in all directions; and when the cirios attain their 50-foot height, the root pattern forms an almost solid blanket beneath the soil. Sometimes after the rare desert rains have brought about the growth of grasses on the usually arid sands, the effect of the underground root system and its drainage of life-giving elements can be plainly seen. The ground for many yards on all sides of these scattered plants is practically bare by comparison with other areas where the cirios are not present.

Just as the cirio is strange in life, it is also strange in skeleton form. In death, the long straight shafts turn a yellow-white; and when the bark and inside pulp has rotted away, you see only a circular wooden wall pockmarked with thousands of small holes. Some of the quarry workers at the onyx mine at El Marmol have utilized these skeletons by sawing them into cross sections and hanging them as rustic garden baskets. If they were more plentiful and transportation were not such a prohibitive problem, they would be in popular demand here in the States.

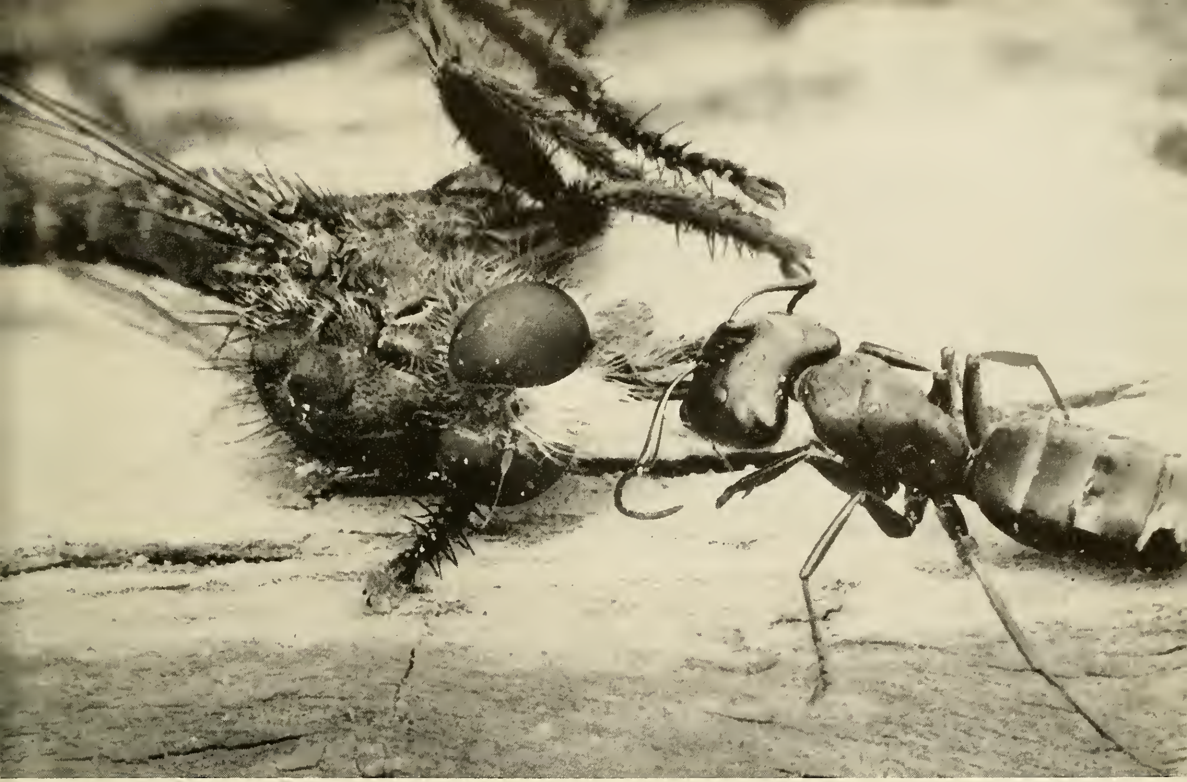
Occasionally, the living trees develop some imperfection that allows the Italian honeybees, which have spread into this area, to invade the hollow center. Some residents of the town of Punta Prieta in the heart of the cirio country make their entire livelihood by robbing boogum hives, and they report that a big tree will frequently contain over one hundred pounds of honey.

Throughout most of the belt where the plants exist, which is 300 miles from north to south, the exotic contortionists might not be called beautiful. But in a few valleys, groves of them have become infested with a picturesque lichen, similar in appearance to the Spanish moss of the southern swamplands. In these localized regions, the stern rigidity of the plants is softened with wind-blown tassels of browns, grays, and greens. Although these blighted trees are no doubt doomed, they become increasingly attractive as they wage their losing battle for survival. Scattered about the ground, however, in these parasitized groves there are countless ball-shaped young. A score of wet seasons or several score of dry will bring them to maturity, and by that time the beautiful but disastrous lichens may have moved on to clear some other area.



▲ An elephant tree and a boogum

▼ After planting two arms, this boogum continued to strive for height



▲ A MAJOR WORKER of *Camponotus pennsylvanicus* (a posed specimen) about to tear down a captured robber fly before carrying the pieces to its nest

Carpenter Ants

The domestic affairs of these master "woodworkers" indicate that their reputation for destruction may be exaggerated. But if you find them a nuisance, there are effective means of control

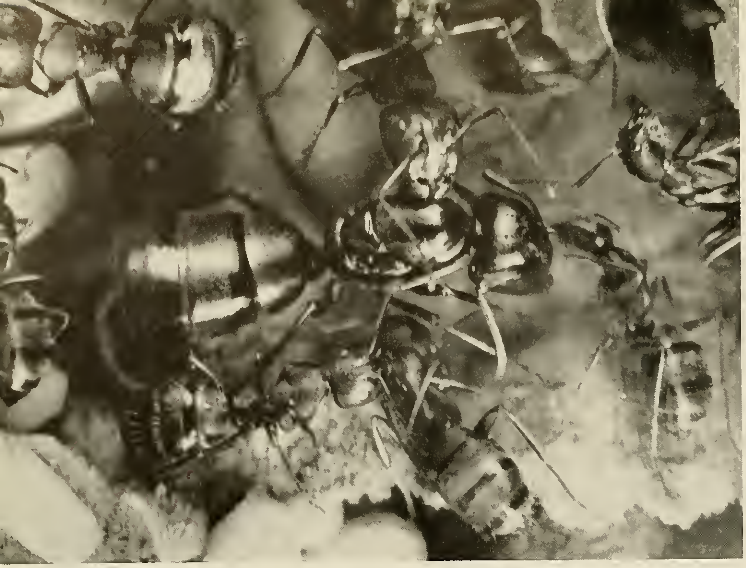
By T. C. SCHNEIRLA

Curator, Department of Animal Behavior, American Museum of Natural History

Photographs by LYNWOOD M. CHACE

THESE ants of the genus *Camponotus* are popularly known as "Carpenter Ants" because they work in wood. It might be more fitting to call them "wood-carving ants," because they do not actually build of wood but gnaw out the soft or partly decayed interior of logs or stumps. When this wood-carving process is carried out extensively by a colony living in the forest or in a human habitation, the interior wood is virtually riddled. In the final stages, the chambers and galleries of the ant nest are separated only by thin partitions or narrow pillars.

You may have had opportunity to examine the extensive galleries of a colony of these ants in a felled tree, or you may have heard a neighbor express his anxiety at having carpenter ants in his house. It is easy to gain the impression that these ants are deadly enemies of trees in general and of people inhabiting wooden houses. Before attempting to assure you that the problem is not always as desperate as it may appear, I suggest that you acquaint yourself with some of the interesting habits of these creatures. A simple and effective artificial nest can be constructed by putting some of the ants and some wood from their home nest into a quart bottle. The bottle is then covered with a piece of cloth for the next few days, or long enough for the part-colony to become established. A rubber or glass tube may be used to connect the bottle with a smaller bottle or a glass-topped box that serves as a



▲ A MATURE QUEEN of the same species, divested of wings after mating, in the company of workers. One of the workers is licking the queen's thorax. The workers are strongly attracted to the queen, especially because of her fragrant odor, and they spend a large part of their nest time licking and polishing her body

food place. In an artificial nest of this sort, the ants will thrive on a diet in which sugar-water, pieces of insect body or cooked meat, and boiled egg are given successively.

This setup may be used to carry out many interesting and instructive tests on the behavior of the ants. For example, a path may be complicated by a simple maze apparatus, and the learning of specially marked workers may be tested. Or orientation to visual stimuli may be investigated by shifting a light to the opposite side of the path after the workers have established their route. In this and similar tests, the disruptive effects of changes in the route or its landmarks should give useful clues as to how the habit of traversing the maze was established.

The ants are blind to red light, so it is possible to observe the colony with its brood and queen in one of these artificial nests without disturbing their activities. Thus the domestic affairs of the Camponotus colony can be worked out through careful observations. The manner in which workers feed one another, the queen, and the larvae by the regurgitation of the liquid contents of their crop merits detailed watching. As W. M. Wheeler demonstrated in his important book, *The Social Insects* (Harcourt, Brace: 1928), these exchanges among individuals, together with similar acts such as the licking of larvae and the queen's body surface by workers, and of worker by worker, provide the basis for the essential unity of the colony.

Another kind of interchange occurs when the colony is roughly disturbed, as by a sharp rapping on the artificial nest or on the shell of the log housing a colony in the open. Then the workers, and especially the largest (or major) workers, rush excitedly about, spreading the excitement and alerting the colony not only by the actual physical collision of antennae and bodies but by another and indirect means. This involves the rapping of the abdomen (and sometimes the head) against the wooden substratum, a procedure that sets up vibrations which reach other workers through the wood, exciting them at some distance. In an artificial nest provided with a floor of hard cardboard, the abdomen rapping of agitated workers gives rise to vibrations audible to the human ear as a rapid patter of faint drumbeats.

In many subgenera, species, and subspecies, ants of this genus are found almost throughout the temperate and tropical zones around the world. Species such as our ubi-

▼ WORKERS with the whitish grubs, or larvae. The worker in the upper center has its mouth part against the mouth of a larva, regurgitating the liquid content of its "social stomach." The smaller workers engage more frequently in this than the larger ones. Big larvae produce soldiers, smaller ones workers of the intermediate and minor castes. But here some of the size difference is due to difference in age. *(C. pennsylvanicus)*

quitous *C. pennsylvannicus* and its reddish subspecies *C. pennsylvannicus ferrugineus* of the north-temperate regions are characteristically found in shady woodlands, where they generally establish their nests in stumps and fallen trees. The excavations of many species like *C. pennsylvannicus* are made mainly in wood; the nests of others like the subspecies *C. pennsylvannicus ferrugineus* are tunneled extensively in the soil and only secondarily in the wood above; while the nests of other species like the yellow *C. castaneus* of our northern states are burrowed exclusively in the ground. Under propitious conditions, standing trees are frequently entered by some of the species; and among these species, *C. pennsylvannicus* often makes its nests in the wood of human dwellings. Perhaps the most specialized and curious of all Camponotus nests are those of species in the subgenus *Colobopsis,* mainly confined to the southern states. Colobopsis nests are found in hollow twigs or in galls; however, they are not very easily found, for their small entrances are plugged against come-what-may by the curiously flattened heads of the major workers, inserted like corks into the openings. The living door remains in place until a few short taps from the antennae of a returning worker on the outside, or a brush from an ant ready for exit on the inside, causes it to open and stand ajar briefly.

The colonies of the black species *C. pennsylvannicus* and its subspecies *C. ferrugineus* of the American temperate zone may grow to be fairly large. There may be as many as a few thousand workers, a single reproductive female (the queen), a brood of varying make-up, according to the season, and at certain times of year a considerable number of young winged males and queens. As with many other species of Camponotus, the workers (or neuter females) are polymorphic; that is, they range in size and type from the large and robust workers-major to the smallest, the workers-minor. The queen is readily distinguished from the workers by her great size, her large head and bulging thorax, and by the high polish she generally acquires from the almost incessant licking and stroking of her body by workers.

▼ Carpenter Ant workers busily transporting their brood away from a scene of recent disturbance, a human invasion. Ordinarily, as the outer shell of their nest log warms up during the morning, the workers transport their brood from inner chambers to sections near the bark. *(C. pennsylvannicus)*

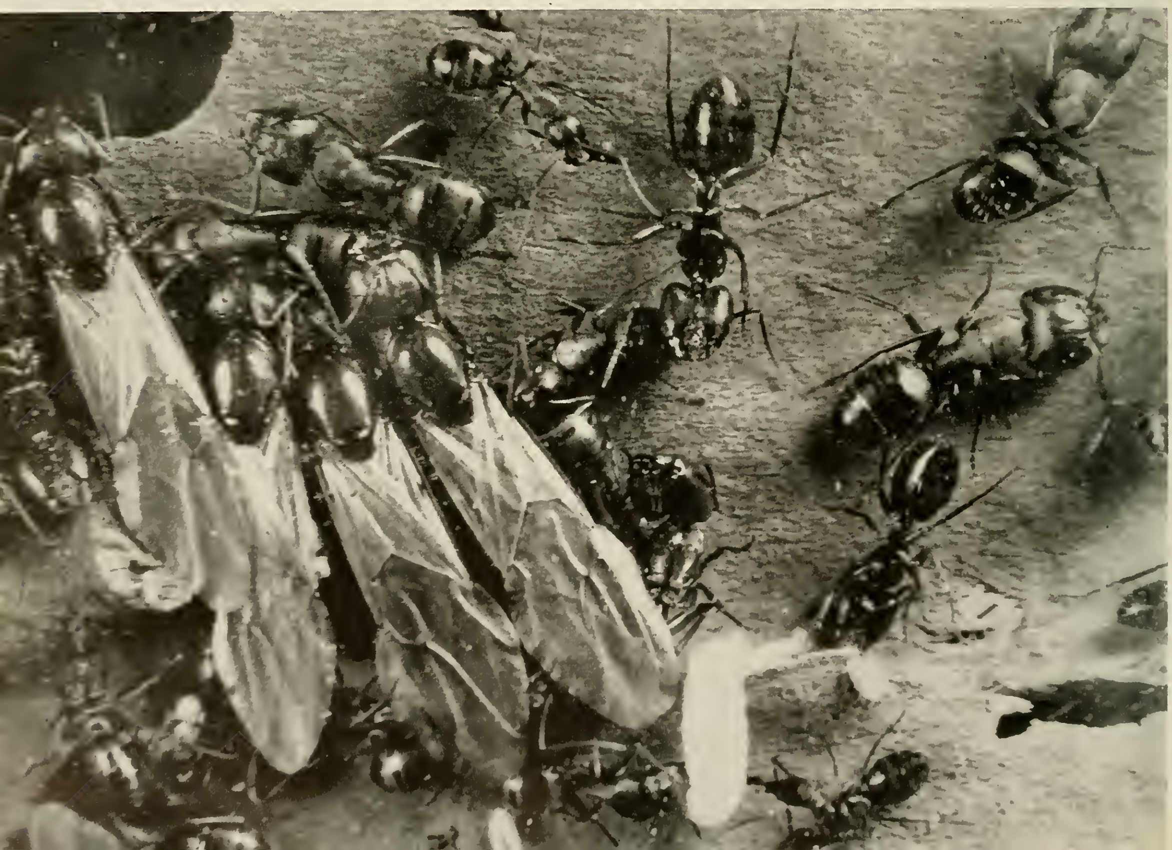
Colonies that have weathered the hazards of their first two or three years are usually able to produce reproductive individuals—the large winged males and females. The late-summer brood of males and females, after emerging from their large cocoons, usually remain in their parent nests through the winter, huddled in clusters with the hibernating workers within the inner recesses of their catacomb-like shelter. They make their exodus early in the following warm season, in late spring or early summer as a rule. If the occupants of a house have been unaware of a flourishing Camponotus colony within the foundation beams, the discovery is likely to come on some warm day in late spring, when from some chink in the molding a whole host of males and numerous females may come out into the room.

In the open, the winged males and females spill out of their home nests on the warm and bright days from May into July and soon take to the air in a mating flight. This results in the fertilization of many of the females. In contrast to the large-eyed but tiny-headed males, which cannot survive long as solitary individuals after the flight, many of the inseminated queens return to some woody surface or to the earth and are able to establish themselves. Fascinating and unsolved problems are presented both by their behavior and their physiology, which seem to change markedly after fertilization has taken place.

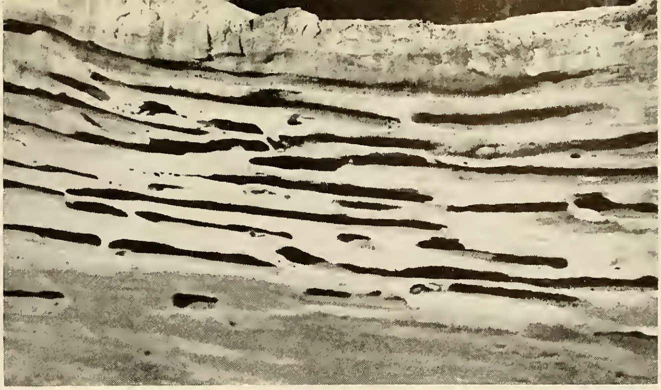
When a fertilized queen descends from her flight, she drops or bites off her wings, then soon becomes photo-negative. That is to say, she is markedly light-shy, whereas before fertilization she was light-positive, as indicated by upward spiraling toward light in the mating flight. As a result of this change, when the newly fertilized queen reaches a sheltered dark place, she settles down. If accidentally exposed to light, she again promptly disappears from view. In the northern states, if you pull strips of bark from logs and stumps in the late spring, you are likely to expose one or more newly established Camponotus queens. Each is in a little cell ringed around with a wall of wood fibers set up by the queen herself. Or she may find her way into the deserted burrow of a tunneling wood beetle in which she comes to rest at some turning. She may perish through seasonal vissicitudes or through the invasion of her cell by ants or other predatory insects. Otherwise, however, the young queen can survive by living on her own tissues and can found a colony through her own resources.

Her now degenerating wing mus-

▼ Workers, larvae, and winged females, recently installed in a glass-topped artificial nest. *(C. pennsylvanicus)*



▲ A WORKER about to lap up the sweetish fluid secreted by one of the aphids on this stem. Note her antennae, the slow oscillation of which has been caught by the camera. *(C. pennsylvanicus)*



▲ CHAMBERS AND GALLERIES of a Carpenter Ant colony carved out in the soft interior of an old log. The chambers are long and wide and are connected by narrow galleries. Notice how the excavations run mainly with the grain of the wood. The excavated chambers and galleries occupied by a flourishing *Camponotus* colony may extend as far as a few feet along the log

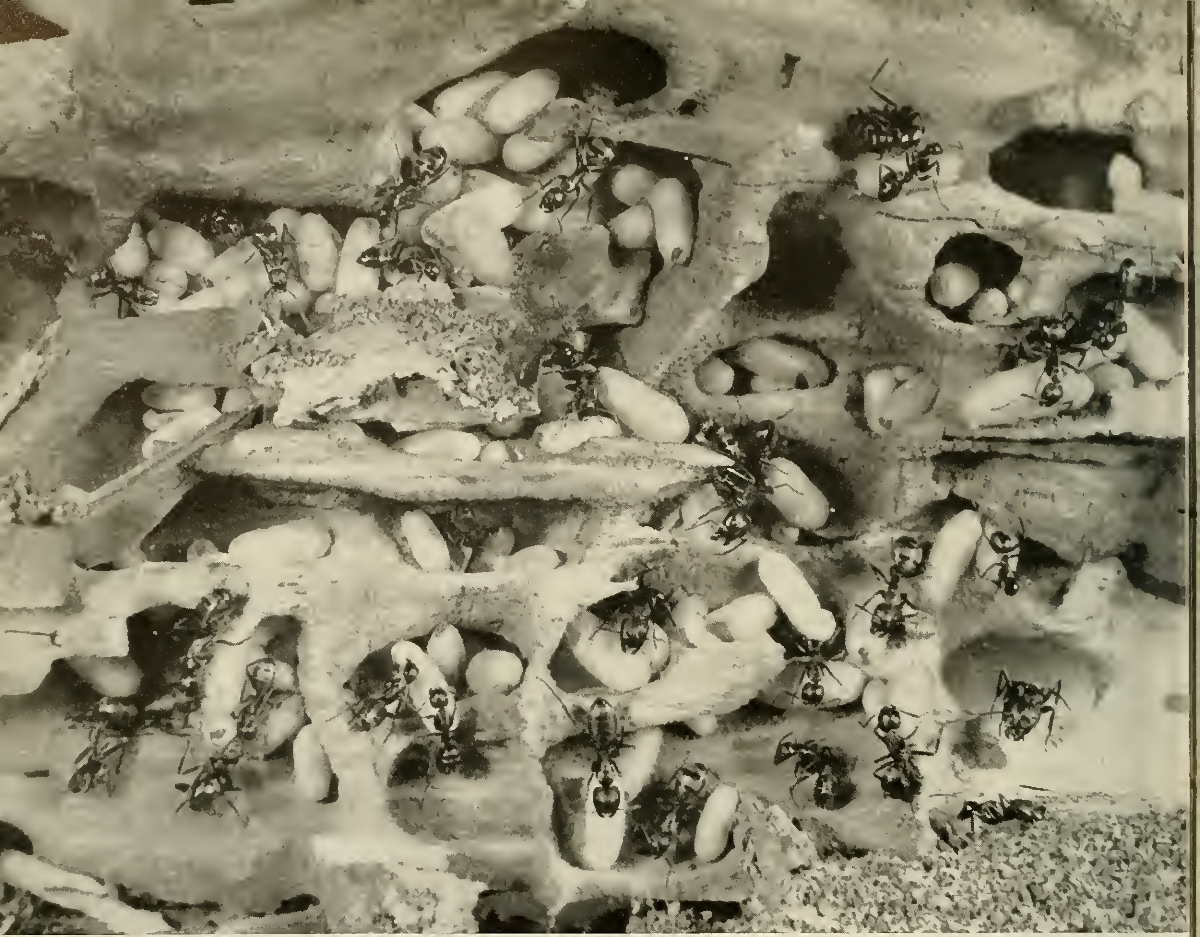
cles and the fat bodies with which she is abundantly equipped provide nourishment for her and her first brood. For, unlike the colony-founding queen of some Australian ants of primitive ponerine species, which leave their cells and forage about, thereby procuring food for themselves and for their first brood, the Camponotus queens remain sequestered and have no food except what is available from their own bodies. On this special "reducing diet," the queen soon begins to lay eggs, and with this substance she can feed the larvae which presently appear.

That the first brood is not lavishly fed by the queen is evident from the very small stature of the few workers that appear in the first lot. They are all of the worker-minor caste. However, these diminutive workers may succeed in consolidating the young colony by slowly extending the nest and by foraging in the environs, bringing in food that is used to replenish the queen's reserves and feed the additional brood. If the first pygmy workers do not carry out such work effectively, the colony is likely to perish. If they work well, the population grows and the nest is extended into wood and earth. As soon as the first workers have appeared and are busy in the nest, the queen turns to producing eggs as her exclusive task. Thereafter she labors no more except in this important capacity as egg-making machine.

Once a colony has gained its first good foothold, the larvae presently are sufficiently well fed and develop into workers of the larger type, the intermediates or majors. With a good food supply, a temperature near 75 degrees F., and not too much or too little moisture in the air, the workers of *C. pennsylvanicus* require a little more than two months for their complete development from newly laid eggs to the callow (or newly emerged adult) stage. This period is divided roughly as follows: 23 days from the laying of the egg to its hatching into a larva, 21 days for the growth and maturation of the grublike larva, and 21 days for the development of the mature larva within its cocoon into a prepupa and then into the adult-like pupa. Sunny and somewhat humid weather generally hastens development; cool, unusually variable, or very dry weather is likely to retard development. Although the workers require the larger part of a summer for their development, they are adults when the pupal stage is finished and grow no more after they emerge from their cocoons. In this they are very unlike the termites.

The hardiness of established colonies of carpenter ants is due not only to the excellent insulating properties of their dwellings but also to the fact that most of them can subsist on a variety of food. The larder has as its main item large supplies of nectar obtained regularly through spring and summer from honeydew produced by aphids and other "ant cows," which the Camponotus workers visit on surrounding plants. The ants also gather considerable quantities of insect flesh. They work both as scavengers, collecting dead insect bodies in the neighborhood of their nest, and as predators, bringing in freshly killed insect victims. The foragers are generally able to bring their live captives under control by biting them with their powerful mandibles and also by squirting especially resistant subjects with formic acid.

In our diurnal species such as *C. pennsylvanicus,* which do most of their foraging in the daytime, an intermittent traffic of workers is usually to be observed making re-



▲ Adult workers with brood, mainly pupae in cocoons. In this stage, the young worker matures from the larva into the adult form. When newly emerged, it is gray because of incomplete pigmentation. Within a few days it shows the jet black of regular adult *pennsylvanicus* workers

peated excursions to near-by plants where aphids are feeding. Each time a worker mounts a plant, she begins to stroke the aphids with slowly oscillating antennae, thereby stimulating the emission of their sticky, sweetish secretion. After lapping up enough of the nectar to fill her crop, thereby stretching out the walls of the gaster, or abdomen, very noticeably, the worker hurries off to the nest with her heavy afterpart waggling in a manner that the observer is likely to find quite amusing. At the home site, the load is regurgitated to other workers, with a frenzy of rapid strokes of antennae as the food transfer begins, then with slow regular antennal movements as the food transfer gets under way. Emptied of her load, the aphid-visitor rushes off with crop contracted and abdomen small to obtain a refill at the source of supply. The trips continue in this way for many hours, and one worker may make dozens or scores of food-gathering trips in a single day. It is interesting to note that the nectar-gatherer may make most or all of her visits on a single day to the same part of the same aphid colony on a particular plant. At the same time, other foragers are specialized in capturing and lugging either dead insect hulks or freshly killed prey.

The destructiveness of carpenter ants to wood is not always easily appraised, and there are divided opinions on the question, even among specialists. It is argued on the one hand that while these ants and their work frequently may become a considerable nuisance, especially around dwellings, the actual extent of the damage they do may not be nearly so great as imagined. In most cases, it is contended, the carpenter ants make their nests in wood that is already softened by decay or penetrated by the burrows of wood-boring beetles. The Camponotus technique of wood-riddling may actually no more than hasten the inevitable decay of presoftened wood. The degeneration of doomed trees, logs, and stumps is of course an ordinary and a biologically essential factor in the life processes of any forest, and Camponotus colonies incidentally make their contribution to these processes.

There are others, with many forestry specialists and entomologists among them, who insist that Camponotus colonies must be considered destructive in the last analysis. It is pointed out that in less settled areas the more common *Camponotus pennsylvannicus* generally nests in standing timber and not only in partially rotted trees but also in sound ones. This species also has been found tunneling in the sound dry wood of telephone poles, cabin posts, and the rafters of buildings, which may have been invaded in the first place through cracks as well as through damaged or decayed places. This species, therefore, is put down as a frequent offender against man's interest in timber and in the wood that he uses. It appears also that relatives, such as members of the American *Camponotus herculeanus,* which live in the coniferous forests of the northern states and Canada, frequently enter standing trees and hasten their destruction. The various Camponotus species are not equally blameworthy from this standpoint; for example, *C. ferrugineus* is found almost always in predecayed wood, such as that of logs beneath which the colonies have excavated their nests in the soil.

With the advent of European man and his wooden structures in America, Camponotus has had the opportunity to invade human habitations in much the same way as wood is entered in the forest. *C. pennsylvannicus,* in particular, is frequently found in houses near woodlands. Where cracks, crevices, and faulty joints exist in beams and other exposed wood parts, the entrance of these ants is facilitated, and nests may be established if the interior wood is soft enough to be worked. Colonies may also establish themselves in piled lumber sometimes moving over from fireplace logs heaped near by.

Householders can greatly reduce their troubles with carpenter ants by the appropriate use of paint and tar on the rafters and beams of houses and other wooden structures near wooded areas and by storing spare lumber with discretion. It is doubtful that Camponotus often causes serious damage to really sound wood. The unpopularity of these ants in many quarters seems rather to result more from their nuisance value than from any actually identified destruction. However, if you prefer, as most householders do, to study Camponotus at a safe distance from your home, steps may be taken to remove them. Dr. C. H. Curran recommends spraying the entrances to the nest with a one-half per cent water emulsion of D.D.T. or Chlordane. The fluid should be soaked thoroughly into the wood. In extreme cases, holes can be bored in beams and rafters through which it can be forced into the interior of the nest. Tests carried out at Bear Mountain showed that a water-base insecticide is satisfactory, whereas an oil base is not, because it does not soak well into wood. If thorough, such measures should be effective in destroying a colony.

An interesting relationship between carpenter ants and man has been discovered recently in Florida. In the spring, before the winged Camponotus males and females carry out their mating flights, the orange growers are engaged in "dusting" the trees in their groves. Not uncommonly the sacks are strewn on the ground near the trees or at the edges of the grove. Although such a result is probably far from the minds of the orange growers, the empty sacks afford good cover for the queens of the common reddish *Camponotus floridanus*[*] and for their young colonies as they develop. The relationship must be partly beneficial to the orange groves by ensuring a supply of Camponotus workers to reduce the population of injurious insects in the grove. On the other hand, it may prove more detrimental than helpful, depending upon the extent to which the ants remove beneficial as well as injurious insects or stimulate plant parasites. Investigation seems in order, to show whether for the sake of the orange crop, the growers should pick up their sacks.

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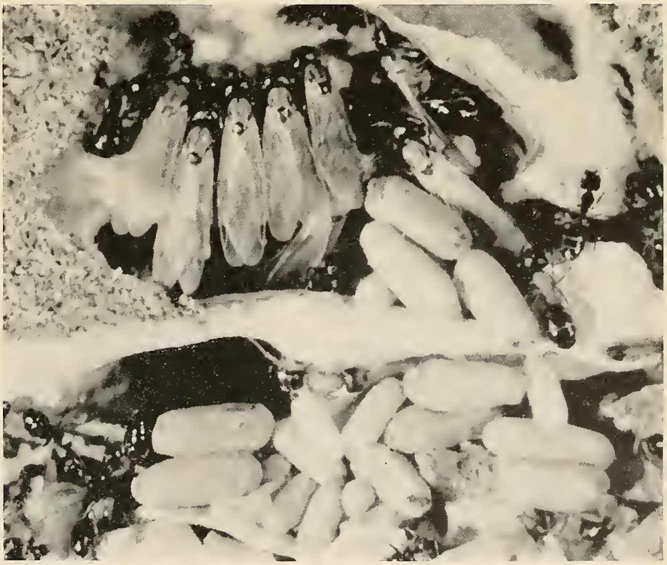
[*] *C. (Myrmothrix) abdominalis floridanus* (Buckley).



➤ A GROUP of Queen Carpenter Ants with wings. They will soon swarm and mate and fly to a new location, where the Queen will begin a new colony. The Queen loses or cuts off her wings after reaching the new location

▲ THE GIANT TORTOISE succumbs quickly to civilization. It is hoped that secrecy will protect the large groups recently discovered on Indefatigable Island until protective laws can be passed and enforced.

Strange Reptiles OF THE GALÁPAGOS

By ROLF BLOMBERG

All photographs by the author

These "Enchanted Islands" support some of the oldest animals alive on earth and have been of special interest to biologists since Darwin's memorable visit

WHICH are the oldest living animals in the world? In all likelihood, certain tortoises are—perhaps the ones living on the Galápagos Islands. It is believed that the largest specimens have reached ages of 200 to 250 years. In other words, these old fellows, whose acquaintance I recently made in the Galápagos, could have been youngsters at the time of George Washington's boyhood.

And how big are the biggest? It is hard to weigh a tortoise, and I certainly was not equipped to try. But a Galápagos tortoise that was brought to California in 1899 may give some idea. It weighed only 29 pounds at the time, but when it died only 15 years later, it weighed 415 pounds.

Legend has it that the first human beings to visit the Galápagos Islands and see these monsters were the Inca Emperor Tupac-Yupanqui and his followers, long before the Spanish Conquest. But the first historical report dates from 1535. It was in that year that Tomás de Berlanga, Bishop of Panama, set sail for Peru. After a week of favorable winds, he was becalmed, and for eight days he drifted helplessly in the Pacific, driven off his course by strong currents. But on the eighth day he unexpectedly sighted some islands on the horizon and by mere chance discovered the Galápagos Islands.

This isolated group of Pacific islands is situated on the equator, about 500 miles west of the South American continent. The islands belong to the Republic of Ecuador, and their official name is the "Archipiélago de Colón" (the Columbus Archipelago). One often hears them called the "Enchanted Islands," and William Beebe gave them the striking name of "World's End." The islands spread over an area of nearly 3000 square miles, but only 13 or 14 are large enough to be marked on small-scale maps. The largest island, named Albemarle or Isabela (every island has two, often three names), is about 95 miles long and 15 miles wide. Some of the largest islands, which at the same time are the highest, are suitable for agriculture and settlement, but most of them are too arid.

The characteristic appearance of the dry coastal belt is given it by the cacti and scraggy brush that cover it. In the uplands, above 600 feet, the vegetation changes and becomes more fertile, and here forests and grassy plains flourish. In 1832, the islands were officially annexed by Ecuador and the first settlement was founded by the Louisiana-born general José Villamil. But the population of the islands has never increased to a large extent. The present population is now less than 2000 inhabitants and is formed mainly of Ecuadorian settlers from the mainland. It is noteworthy that on Indefatigable (or Santa Cruz) there

▲ CACTUS and scraggy brush cover the coastal belt. The Galápagos are volcanic in origin. The climate is healthful

exists a small isolated Norwegian colony.

The Galápagos Islands are composed throughout of volcanic rock, and Charles Darwin states that the number of volcanoes he found on the islands exceeded 2000. However, nearly all of these are extinct, and eruptions occur only on Albemarle and Narborough (or Fernandina) Islands.

The climate is tempered by the cooling influence of the Humboldt Current; and the absence of malaria, poisonous snakes, and other tropical drawbacks makes the islands ideally healthful. Another favorable characteristic caused by the Humboldt Current is the abundance of fishes, which have caused these waters to become the permanent haunt of a large fishing fleet from California.

The archipelago has gained fame in the scientific world because of its fantastic fauna and flora. Darwin visited the islands on his around-the-world cruise in the "Beagle," and the observations he made there

▼ TOP SPEED: 360 yards an hour. The giant tortoise is almost oblivious to sound, but its sight is keener

▲ Upside down. When the giant tortoise withdraws into its shell, the air is pressed out of its lungs with a hissing sound "like an echo from prehistoric ages"

▲ The giant tortoise moves like a tank and is well protected. But eggs and young are very vulnerable to rats, dogs, and pigs

were of the greatest importance to the development of his epoch-making theory of evolution. Since Darwin's visit, a great many other scientific expeditions, mainly American, have explored the islands.

The best-known representatives of the Galápagos fauna are no doubt the giant tortoises known in the Spanish language as "galápagos," for which the islands have been named. Once upon a time these strange reptiles abounded in all the islands, but with the appearance of pirates and whalers in the Pacific, they were killed off in large numbers and stored as provisions aboard ship. In 1814, the famous sea captain David Porter reported that whalers passing the islands made it a practice to capture 200 to 300 of these tortoises and store them in the hold. They could survive for a whole year without food or water and served as a supply of fresh meat. When at last they were killed, they had lost nothing of their fatness or flavor. Enormous numbers were killed and carried away from the islands. Between 1811 and 1884, an estimated 16,000 were taken by whalers, according to the well-known biologist, Charles H. Townsend. Little is known of the numbers killed by buccaneers or those killed on the spot for their oil, which Captain Porter described as being far superior to olive oil in taste. At the end of the nineteenth and beginning of the twentieth centuries, actual expeditions were fitted out to capture and slaughter the defenseless giant tortoises to obtain the oil.

But great as the destruction no doubt was, it is safe to assume that the more serious reduction in numbers has been caused by the introduction of other creatures hostile to the existence of the tortoise. The rats, dogs, and pigs brought to the islands by man multiplied in an incredibly prolific way and were dis-

▼ If you catch a sea iguana, two jets of aqueous vapor will issue from its nose. But the creature is harmless and will not even try to bite

astrous to the tortoise, since they fed on the eggs and young soft-shelled animals. On some of the islands the giant tortoise has already become extinct. It is only in the interior of Indefatigable (or Santa Cruz) and Albemarle Islands that one can still find them in larger numbers.

The photographs illustrating this article were taken on the island of Indefatigable. During the last war, when the United States had a military base on Seymour Island, reconnaissance flights were made all over the archipelago to locate fresh-water sources. When circling over a steppelike region of Indefatigable, a few bodies of water were spotted, and in and around these pools large groups of tortoises were also discovered. Following the indications of the airmen, some of the island settlers made an expedition inland and found a large number of record-size tortoises feeding on the plains and taking mud baths in the shallow water. The settlers have been wise enough to keep this discovery to themselves, but knowing that the author's hunt would be a bloodless one—his only weapon being a camera—they gave information regarding the exact location of this colony of tortoises in exchange for a formal promise of secrecy.

To see these giant tortoises forcing their way through the brush is a most eerie sight. They walk slowly but relentlessly over the shrubs and the cacti at a top speed of 360 yards an hour, and their movement is strangely reminiscent of the mechanical action of a tank forcing its way through rough terrain. They seem almost impervious to sound; a gun can be fired behind them without causing any reaction. Their sight is keener than their hearing, and they can perceive the intruder from a long distance away, whereupon they snuggle their head and feet inside their shell. As they do this, the air is pressed out of their lungs with a hissing sound that is like an echo from prehistoric ages.

Once a year the females descend to the dry coastal region and dig in the red earth, where they deposit their eggs. The eggs are round and

▲ SLOW FREIGHT. Notice the bait, which actually works

▼ THE WORLD'S only marine iguana is about four feet long and looks like a holdover from the age of reptiles

▲ **The land iguana** is not so mild tempered as its marine cousin. It can inflict serious bites with its strong-toothed jaws

▲ **If this iguana** turned to bite, it could easily sink its teeth through its captor's boot leather

white, a bit bigger than a billiard ball, and are placed in layers of three to six eggs, in a hole a foot deep. The nest is then covered with a hard, easily recognizable crust. According to the Galápagos settlers with whom I spoke, the crust is formed by the mother tortoise, who, after having laid her eggs, soaks the earth with her urine.

Another very interesting Galápagos reptile is the world's only marine iguana, *Amblyrhynchus cristatus*. More than four feet long, this extremely ugly and prehistoric-looking lizard is completely harmless. If you catch an *Amblyrhynchus*, it will not even try to bite you; it will only nod its head angrily and spout from its nostrils two jets of aqueous vapor that make it look very much like a dragon. However, if it succeeds in escaping between the rugged lava boulders of which the seashore is composed, there is very little hope of catching it. It digs its twenty sharp claws into the porosities of the rock and inflates its body at the same time, so that no matter how one may pull and heave, the iguana holds on as though in a vise.

The sea iguanas are so unafraid of man that they barely budge when one moves among them. They

◄ **The land iguana** will even eat a cactus pad bristling with needle-like thorns appear on the black lava shores in colonies, sometimes numbering thousands. When the tide is high, they usually lie around lazily basking in the sun, but at low tide they slowly creep down to the shore to feed on the seaweed and algae left uncovered by the receding sea.

Although sea iguanas dive and swim with great skill, they are not often seen in the water. Their worst enemies are the herds of wild dogs and the sharks, and not infrequently one may see specimens with bitten-off tails.

Amblyrhynchus has a cousin of about the same size on terra firma – the beautifully-colored *Conolophus subcristatus*, whose temper is definitely less gentle and mild. In some places they still exist in large numbers, but in others they have been decimated by men and dogs. For the most part they are to be seen lazily vegetating in the shadow of a big opuntia or strolling around feeding on leaves and flowers. They feed even on the opuntia leaves, which have thorns that resemble darning needles. If one disturbs their activities, they nod in protest and occasionally hurry off at a ridiculous gait with their legs spread wide apart, to hide in their holes under a stone or in the earth. If caught, they angrily try to bite with their strong-toothed jaws and can inflict a serious wound. One angry *Conopholus* bit right through one of my boots.

The only other reptiles of the Galápagos are some lesser lizards, a harmless snake, and the sea turtles.

The outlook for the Galápagos reptiles is gloomy; they are diminishing at a disastrous rate. At the time of writing there is a project underfoot, initiated by both Ecuadorians and Americans, which proposes to have at least some of the islands declared national parks. It is to be hoped that this excellent plan will be carried out before more irreparable damage is done.

The strangeness of these isolated volcanic islands and their almost incredible fauna and flora should stir everyone to support a plan to protect them from further inroads.

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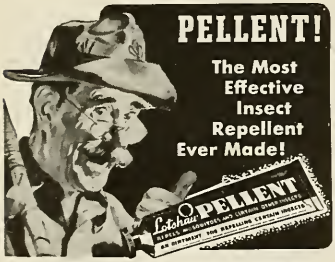
have a strong suspicion that the mysterious night bird was a Cayenne Crake, a member of the family of rails, water hens, gallinules, and their immediate allies. There are not many birds in South America of nocturnal activity that would be capable of such performance as she describes, and this rail is one of them.

My particular reason for this identification is, however, my own experience in Peru a good many years ago. While camped in the forest, I had heard a mysterious voice on numerous occasions but was never able to catch the singer at work. My journal mentions the song as a succession of single tremolo notes on a rising scale of neither quite half nor full chromatic interval. I do not recall that the song ascended as high as Mrs. Irwin specifies, but my memory may be at fault in this particular. At any rate, on going over in my mind the birds that I knew existed in the region where I was camped, I became convinced that this rail was the most likely candidate for the honor of authorship of the midnight song.

Eventually I fell into conversation with an intelligent native whom I had found on previous occasions to be well informed concerning local wildlife. He recognized my description of the song and promised to bring me one of the birds at the first opportunity. When he arrived at my camp one morning with the bird, it was the rail I had suspected. I have confidence that the man was quite reliable in his identification, but I still confess to my failure to link the bird and its song by personal observation.

That Mrs. Irwin did not hear this rail, if it was the bird she heard, in Panama, Colombia, or Trinidad may be explained by the fact that it is quite absent from Panama and Trinidad and rare and of limited distribution in Colombia.



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How Much Is a National Park Worth?

In their efforts to invade the national parks, the exploiters, when brought to task by those who prefer to see these areas preserved for the recreational, cultural, and spiritual well-being of the public, fall back to a defense line based upon dollar values, according to the Wildlife Management Institute. Just what, in terms of dollars and cents, are Yellowstone, Glacier, and Grand Canyon National Parks worth?

Bureau of Reclamation engineers are able, through the magic of the slide rule and comptometer, to determine within fractions the potential output in kilowatt hours of power of a given park dam site, the storage capacity of the reservoir, and the dollars-and-cents value of the commodity produced, and say, "This is the value of the dam." Their opponents can counter only with intangibles. Although an application of the same logic would reduce the value of the Declaration of Independence to two dollars worth of parchment and a fraction of a penny's worth of ink, some tangible figures might be obtained. The defense line is a stiff one when backed by the carefully molded public opinion of the local people who will receive, or who have been led to believe they will receive, all of the material benefits of the construction work undertaken at public expense.

A little-publicized attempt to attack this line in one threatened national park disclosed some interesting information on the material value of the park to the people of Montana. This economic study was undertaken during 1949 at Glacier National Park by Harold Hoflich, a student at Texas A. and M. College, and M. E. Beatty, park naturalist.

It indicated that, in Montana alone, the average visitor spent $39 in 1949. A total of 480,000 visitors spent $20 million in Montana. Since 75 per cent of these people came specifically to see Glacier, the minimum value they placed upon the park was $15 million. This $15 million annual yield to the state of Montana represents an investment, computed at 4 per cent, with a minimum value of $375 million. If figures on expenditures outside Montana had been obtained, the material worth of Glacier to the entire United States would probably be double this amount. Even partial destruction of the park by the construction of dams undoubtedly would result in a much lower income from tourists to the people of the Flathead Valley.

Introduced Weed Provides New Penalties for Land Abuse

By Richard H. Pough

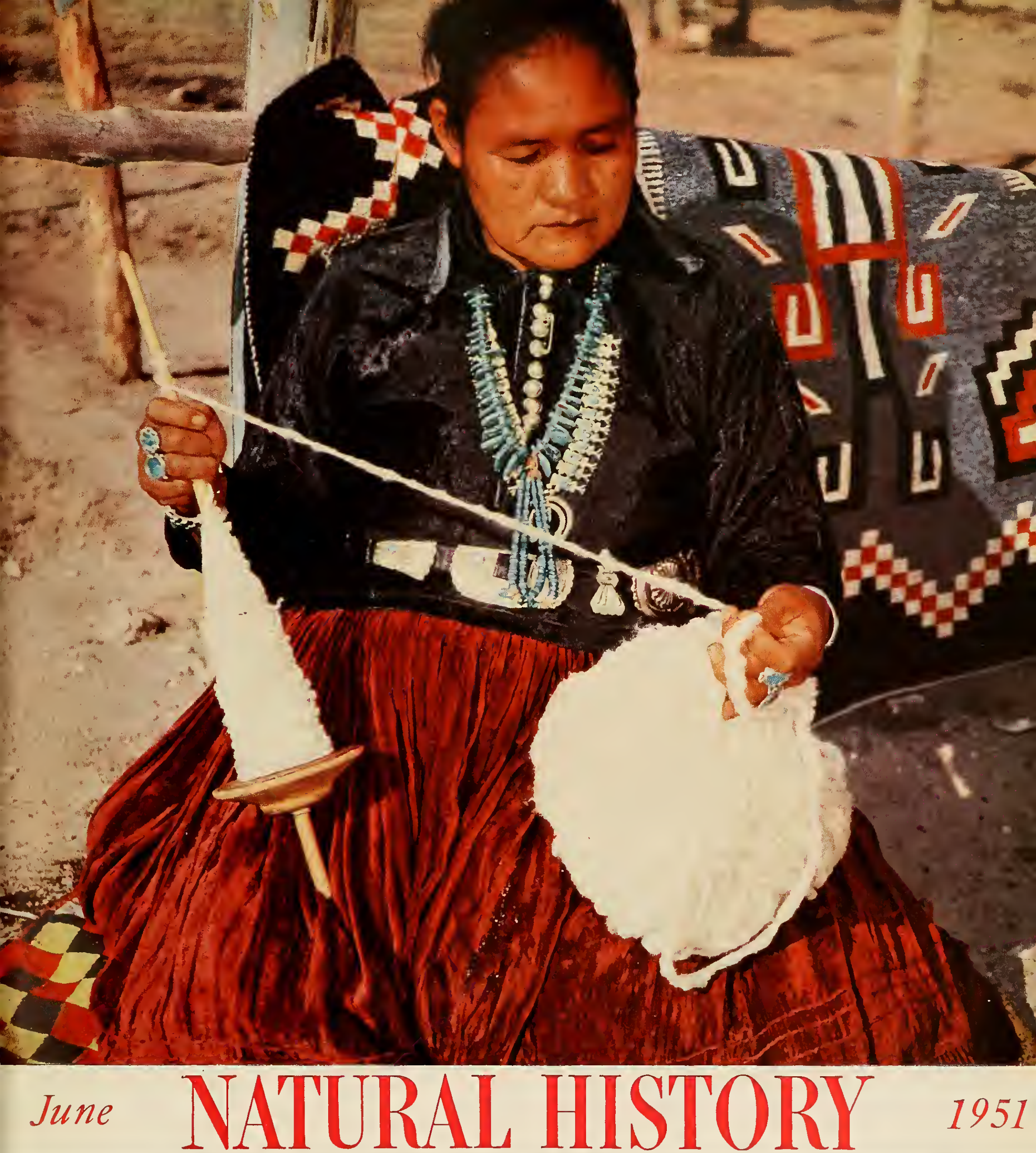
Chairman, Conservation Dept.,
American Museum of Natural History

CONSIDERABLE publicity has been given recently to the serious losses of sheep that a newly introduced plant—*Halogeten glomeratus*—has been causing in the West. Like the ubiquitous Russian thistle which was introduced years ago, it is an Asiatic annual belonging to the Goosefoot family. Apparently this dangerous exotic came over in a shipment of grass seed from Central Asia. Its presence was first detected near Wells, Nevada, in 1935. This nondeportable alien is now estimated to have infested over half a million acres from south-central Montana to northeastern California, the heaviest infestations occurring in northern Nevada and Utah and southern Idaho.

Tolerant of saline or alkaline soils and a prolific seed producer, Halogeten thrives in arid country wherever it can find open ground where its seedlings will not be subjected to competition from well-established perennial grasses and other plants. When its foliage dries in the fall, it may have an oxalate content—mostly sodium oxalate—as high as eighteen per cent, and ten ounces is generally sufficient to kill a full-grown sheep. Death results from the removal of the animal's blood calcium through the formation of relatively insoluble calcium oxalate deposited in crystalline form in the kidneys. Halogeten does not appear to be particularly palatable to livestock at any time; but on overstocked ranges where food is scarce it becomes acceptable, especially to sheep, in the fall when its foliage has dried and it is most deadly.

The value of the land subject to Halogeten infestation is too low to justify such relatively expensive methods as chemical or mechanical control even if they could be perfected. Biological control is therefore the only feasible method. Fortunately, this requires nothing beyond what we already know we should be doing in order that these lands may make their maximum contribution to watershed protection and produce the maximum amount of palatable forage for livestock. In some ways Halogeten may be a blessing in disguise, for it attaches a new penalty to overgrazing of the normally long-lived perennial grasses and to failure to promptly reseed eroded, disturbed, or disastrously overgrazed areas. Unfortunately, the 180,000,000 acres of public land now administered by the Bureau of Land Management have been subjected to such abuse in the past that it is estimated that the bill for their rehabilitation will run over $430,000,000.

Who is to pay it? The stockmen who use these lands? No, you and your fellow-taxpayers who own them and let the stockmen use them for a grazing fee that is only a fraction of what a private owner would charge.



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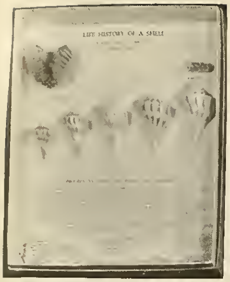
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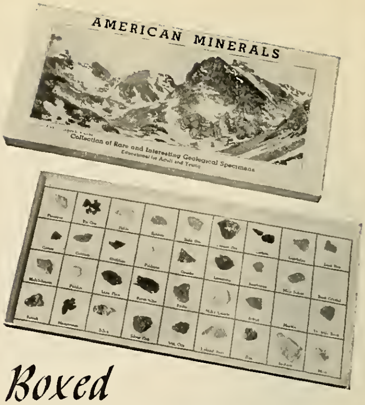
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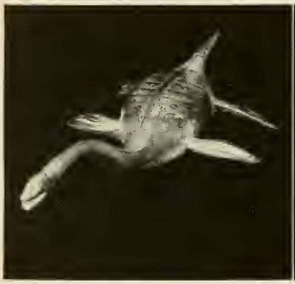

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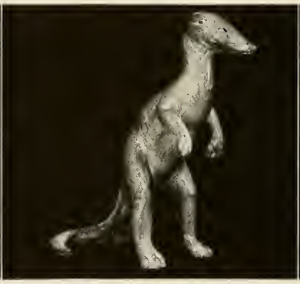

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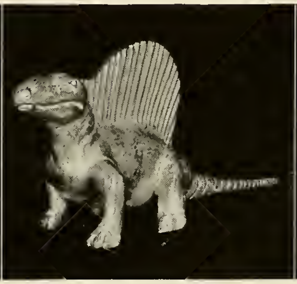

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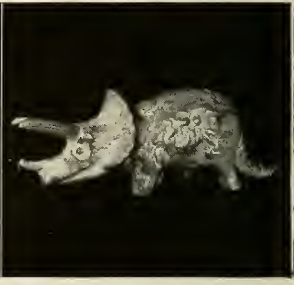

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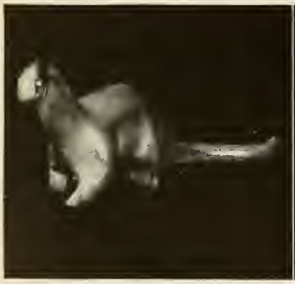

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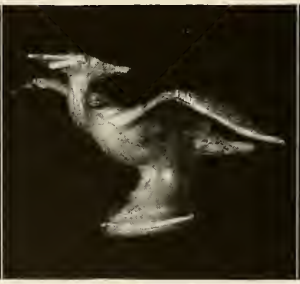

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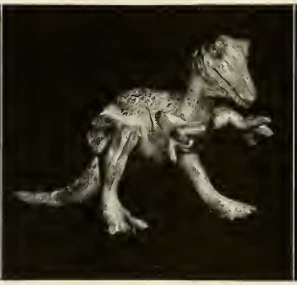

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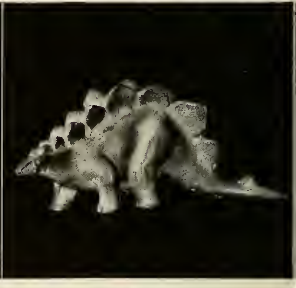

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LETTERS

Swan Song

SIRS:

Does a swan sing a "swan song" when about to die? I wouldn't have believed this until I read *Birds of America,* edited by T. Gilbert Pearson and John Burroughs, published by the Garden City Press. Part of the section concerning the Whistling Swan (written by E. H. Forbush) reads:

"The song of the dying swan has been regarded as a pleasing myth for many years, but Elliot asserts that he heard it once at Currituck Sound, when a swan, mortally wounded in the air, came sailing slowly down and began its death-song, continuing it until it reached the water. . . . It (the song) was plaintive and musical and sounded at times like the slow running of an octave. Inquiry among local gunners revealed the fact that some had heard similar sounds from swans that had been fatally hurt."

But the book never says whether the "swan song" legend is true or not. I don't think either tale is true. But if I'm right, what started these tales in the first place? Are they based on a grain of truth?

ALFRED THOMAS

Essex, Conn.

The following comments are offered by Dr. John T. Zimmer of the American Muesum's Bird Department:

The "song of the dying swan" has never been adequately explained and has usually been considered a myth with no foundation in actual occurrence. Daniel G. Elliot, however, was a careful and accurate observer, and his report of hearing such a performance cannot be dismissed. If he heard such a song, it must have a real existence. The question remains as to its possible explanation.

The trachea, or wind pipe, of some of the swans is a strongly convoluted tube whose trumpet-like shape presumably aids in producing the resonant calls of the species that possess it. It is possible to believe that a milder passage of air through the vocal apparatus than usually occurs would result in a softer musical note. A dying bird, then, under conditions of waning energy but still attempting to

▼ A MUTE SWAN **on a private pond near Boston, Mass. This is the common "tame" swan—a species originally introduced from Europe**

Ewing Galloway photo

sound its clarion call, might produce the plaintive death-song described by Elliot. It might happen that the trachea was perforated by the shot, preventing a full column of air from reaching the syrinx, or "voice box." Perhaps, instead, the syrinx was broken and unable to function to its normal degree, or the only possible notes might be those produced by the trumpet-like trachea.

In any case, "swan songs" may have a perfectly natural explanation, although they are of such rare occurrence that study of them has still to be made. In view of Elliot's observation, they cannot be wholly discounted as pure invention.

Bald Eagle Protection

Representative Homer Angell of Oregon has reintroduced a bill (H.R. 1870) in Congress to extend Federal protection to the bald eagle in Alaska, the Wildlife Management Institute reports.

Although the killing of an eagle carries a minimum fine of $50 in the U. S. proper, the same act pays the hunter a two-dollar bounty if it occurs in Alaska. In spite of the fact that there is no scientific evidence to indicate that the eagle kills many unspawned salmon, the bounty has been maintained for many years because the bird has been regarded by salmon fishermen as destructive of valuable fish. Of recent years, opposition to protective legislation also has come from many in the territory who profit from the bounty. During the past year, bounties were paid for 4,320 eagles, nearly double the 1949 total. The eagle in Alaska and elsewhere will take dead fish in preference to live ones, and around any spawning bed there are enough spent salmon to fill the craws of a great number of scavengers.

A bill similar to H.R. 1870, introduced in the last session of Congress by Mr. Angell, failed to pass in spite of the testimony in its favor by numerous leading ornithologists and conservationists.

AMNH photo

▲ The bald eagle, for which conservation groups are seeking federal protection in Alaska. Killing it now brings a fine in the States and a bounty in Alaska

Shell Trading

Sirs:

I have just begun to collect seashells here in Malta and would like to get in touch with anybody who would like to exchange foreign shells for local ones. As yet, I barely know anything about our seashells, but in time I hope to get to know all the kinds to be found around our tiny island.

Edward James Turner

Faculty of Medicine and Surgery,
Royal University of Malta

Last Month's Editorial

In response to the editorial "Freedom and the Scientific Press," one reader called it communist propaganda, another said it was anti-communist, and a number of others made complimentary remarks about it.—Ed.

NOTICE—Readers are encouraged to submit their own photographs of natural history subjects. Those selected for publication on these pages will be paid for at $3.00 each, with full credit to the photographer. Return postage must be included.

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THE COVER THIS MONTH

This Navaho weaver, with her characteristic silver belt, squash-blossom necklace, and "spider" pendant, is spinning wool for her blanket in the background.

In early times the Navahos probably wore garments of buckskin and robes of buffalo. With the arrival of the Spanish in 1540, they began raising sheep and learned to weave. They wore woolen garments to some extent before adopting their striking modern costume made from richly colored velvets and other trade goods.

They remain famous, of course, for their beautifully patterned wool blankets. For these they wash the wool from their sheep by pouring over it hot water containing an extract of yucca root. The carding is done with a pair of ordinary European hand cards. Various vegetable dyes that were originally used by the Navahos for coloring buckskin and basket materials were for a time employed in some of the yarns for their blankets. But in recent years, the use of aniline dyes has become nearly universal.

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By Cecile Matschat *70 pages $1.75 plus .10**

This book is intended as an introduction to these insects. The author has written the complete life story of over 70 familiar butterflies and moths, including a few rare visitors from other parts of the world whose habits and methods of camouflage are unusual. Many ink drawings and lovely color illustrations.

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PATTERNS OF SEXUAL BEHAVIOR

- - - - - - by Clellan S. Ford and Frank A. Beach

Harper & Bros. and Paul B. Hoeber, Inc., $4.50, 307 pp.

THE publication of *Patterns of Sexual Behavior* is an important event. It is the first time, to my knowledge, that a nontechnical book on the biological and cultural interpretation of sexual behavior has been addressed to the general reader. I am not overlooking the numerous "sex" books that have appeared in the past. Such books, at their best, have simply provided descriptive accounts of human sex behavior to serve as guides to the bewildered, or they have dealt with various physiological aspects of sexual behavior in man.

Ford and Beach, however, have set quite a different aim for their book. Recognizing the variations of sexual experience within a single cultural context, so overwhelmingly demonstrated statistically by Kinsey and his co-workers, they have undertaken the enormously important task of understanding their significance. To do this they adopted a method that included a cross-cultural study of 190 contemporary societies, a comparison with subhuman primates and other mammals, and an analysis of the physiological factors involved. The impact of all this is truly impressive and novel.

We have known for a long time now that social conditioning affects human conduct and creates norms of acceptable custom, but for the first time Ford and Beach show unequivocally that sexual behavior also obeys the same directives. This very lability of sexual behavior in man is especially noteworthy and constitutes an important characteristic of human sexual behavior, which the authors find highly significant in understanding its evolution.

By comparing human patterns of sexual conduct with those of other mammals, the basic similarities and the essential differences are emphasized. Thus the emergence, or even the evolution, of human patterns becomes evident. The authors find an increasing freedom from purely hormonal control of sexual behavior as one advances in the mammalian sequence. The process seems to have reached its greatest development in the human species, where the role of the nervous system often overrides the endocrine basis for such behavior.

In very plain language, the authors describe in full detail the various aspects of sex, drawing upon a rich storehouse of experiment and observation. Their speculations are judicious and cogently presented, but without dogmatism. Throughout they display an open-mindedness that disarms criticism.

Nevertheless, one might raise several questions. For example, little or no statistical evidence is given for the normative sex behavior attributed to the various societies examined. Is the information drawn from one informant or a dozen? Moreover, in the light of the diversity found in our own society, how far can one go in defining the sex pattern of a particular community? These queries, of course, do not affect the fundamental thesis of the book, even though they might conceivably alter certain details.

Stressing as it does the relativity of sexual behavior, a book of this kind opens the way for a discussion of the value judgments that our society or any other places upon certain types of sexual practice. The authors disclaim any intent to enter that thorny field. Perhaps they were right; but since their book cannot fail to open these issues, it might not have been out of place to consider the social consequences of their research.

Patterns of Sexual Behavior is a model of clear, vigorous exposition. It gives a subject that our society has tended not to give the full light-of-day treatment. It deserves a wide and serious reading.

H. L. Shapiro

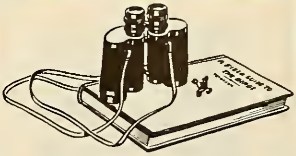
WATER—OR YOUR LIFE

- - - - - - by Arthur H. Carhart

J. B. Lippincott Co., $3.50
312 pp.

THIS book deals with water as a natural resource. Interesting statistics are presented on the over-all pattern of rainfall and what becomes of it. Much emphasis is given to man's dependence on clean water and in per capita quantities that become ever greater as his standard of living and degree of industrialization increase. A brief historical background deals with droughts, climate cycles, and past cultures. Rain making and elementary meteorology also come in for mention.

The growing water shortages that have occurred from coast to coast in recent years provide a background of urgency for this book. Having polluted our surface waters, we have turned to underground supplies, only to find that there are sharp



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LET THEM LIVE

By DOROTHY P. LATHROP
Illustrated by the author

MACMILLAN

limits to the quantities of water they can provide. In short, the author makes it quite apparent that to date our efforts to meet our growing water shortages have been somewhat less than sensible. Instead of cleaning up and using near-by streams, we spend millions to tap distant sources of water for our cities. Instead of putting our watersheds into condition to hold water, we spend vast sums in a losing fight to strait-jacket our rivers with higher and higher flood protection dykes. According to Mr. Carhart, the present plans of the Bureau of Reclamation and the Army Engineers would, if carried out, constitute the greatest folly of all. To irrigate at most 19 million acres of additional western land, these agencies propose to spend an estimated $53 billion of public funds on projects of questionable economic soundness and most projects to date have greatly exceeded preliminary estimates. A fraction of this amount would go far toward saving most if not all of the half-million acres that go out of cultivation every year due to soil erosion and the many millions more that continue to decline in productivity for lack of proper care.

Although recognizing the needs of our industrial age, Mr. Carhart is a man who feels strongly about the importance of leaving more of our country as God made it. Clean streams, which provide suitable homes for trout and salmon, and dam-free mountain valleys and canyons, which delight the eye with their quiet beauty, are in his opinion national assets to be cherished and preserved as long as possible.

RICHARD H. POUGH

GALLERY OF AMERICAN DOGS

- - - - - - - Text by Harry Miller
Photographs by Arthur S. and Katherine Holt Mawhinney
Pen-and-ink drawings by Paul Brown
McGraw-Hill Book Co., $7.50
262 pp., 120 gravures,
119 pen-and-ink drawings

FROM December 14, 1941, to January 4, 1942, there was an exhibit in the American Museum of Natural History of a series of remarkable dog portraits. These photographs were so outstanding that I visited this exhibit a number of times during its all-too-brief stay. Others, too, were enthusiastic. A friend of mine was admiring the photographs and said he wished the set could be published so that he and others could always enjoy them. Fortunately this has at last been accomplished in *Gallery of American Dogs.* Although not all the pictures in the exhibit are contained in this volume, I recognized many, and there are numerous new ones.

This book consists of superb portraits of 128 breeds of dogs, including 113 recognized by the American Kennel Club. Arthur S. Mawhinney and Katherine Holt Mawhinney, who are considered among the best of dog photographers, took the pictures. Twelve years of arduous labor were spent in securing this set.

The author, Harry Miller, is well qualified to write the text accompanying each portrait. Mr. Miller was originally a newspaper man, but his interest in dogs led him to work with them, and he is now Director of the Gaines Dog Research Center. Although the text for each portrait is necessarily short, the information is well chosen and authoritative.

At the foot of each page of text description, there is a well-executed pen-and-ink sketch by Paul Brown, giving the reader a portrayal of the conformation of the entire animal.

This book should be on the shelf, not only of every dog lover, but also of every person interested in fine photography.

T. DONALD CARTER

THE AUDUBON BOOK OF BIRD CARVING

- - - - - - - - - by John L. Lacey
as told to Tom Moore McBride

McGraw-Hill Book Co., $3.50
124 pp., 50 illusts.

FOR the person interested in birds and having a desire to make three dimensional lifelike models of them, this very practical guide will be found invaluable. Modeling with plastiline, making a plaster mold without knowledge of the important parting lines, and finally making a good cast has often ended in frustration.

This is just the book for the amateur who, with step-by-step procedure, will be able to enjoy the satisfaction of doing creative artwork. It was not written for the professional or practicing wood carver.

Many authors tend to confuse the beginner by introducing too great a variety of artistic concepts and too many different techniques. Birdsmith Lacey makes no attempt to display a large knowledge of the artistic or the technical aspects of woodcarving. Because of its very limit in scope, this volume is more clear and usable.

Mr. Lacey helps the reader to choose the most practical wood and proper tools; he does not limit him as to the kind of bird to be carved but does insist on single procedure in working. He explains when and how to use each tool recommended.

There are full sets of designs for various types of birds with minute directions for their use. Instructions are given in detail on surface finish, color, and final display. Mr. Lacey has an unusually good understanding of the beginner's problems and needs. Without fuss he starts his directions at the very outset of the task and does not quit until he and his reader have produced together an acceptable model of a bird. However inexperienced the student may be, success will be assured since all pitfalls have been carefully avoided, and the finished carving will contain much of the knowledge and know-how Mr. Lacey has gone to some pains to accumulate.

Mr. Lacey has been a bird lover since childhood and as such has shown a very keen and observing interest. He was raised in Spoon River County of south central Illinois, a region still abundant in wildlife. I think many hobbyists, bird lovers, and sportsmen alike will welcome this book and through it spend pleasant and profitable hours.

GEORGE E. PETERSEN

HOW ABOUT THE WEATHER?

- - - - - by Robert Moore Fisher

Harper & Bros., $3.00
186 pp., 16 plates

ENOUGH books have been written for the layman on weather and its prediction to stock a sizable library. While some of these fulfill the purpose for which they were published, many are as hazy as some of the weather they describe. This volume, which explains weather facts logically and coherently, definitely belongs to the former category.

The first eight of its twelve chapters review the elements that combine to produce weather and prepare the reader for Chapter 9, "How to Interpret the Newspaper Weather Maps." Illustrated with three series of weather maps for the United States, indicating the day-to-day changes in the weather pattern, this is a worthy contribution to the education of the lay reader.

In addition to this basic material, the book also contains a generous assortment of useful and amusing facts that will prove interesting to any outdoor enthusiast. These include a formula for determining the temperature by counting the number of cricket chirps per minute, and another for estimating the distance of lightning.

Chapter 12, "Forecasting the Weather: How to be Your Own Ground Hog," provides useful hints for guessing tomorrow's weather by studying the weather map and recognizing the meaning of various "atmospheric signals."

In the appendices one can find out how to estimate the speed of the wind and learn many pertinent facts of value in interpreting signs in the sky. The book also contains a good bibliography and a list of facts and figures of practical value to the amateur meteorologist.

All in all, it is as good a book on weather for the nonscientific reader as we have read in several years.

Robert R. Coles

THE MOA-HUNTER PERIOD OF MAORI CULTURE

- - - - - - - - - - - - by Roger Duff

Whitcombe and Tombs,
Wellington, New Zealand
405 pp., 38 plates, 60 figs.

ALTHOUGH the traditions and the genealogies of the Polynesians suggest that they have been resident in the eastern Pacific for 1500 years or more, their culture as it is usually presented has a peculiarly static quality, like something frozen in a fairy tale disconnected from the rest of the world and unchanging in time. This has, in large measure, been the result of a lack of archaeological depth in the study of Polynesian culture. In most of the islands only the life that existed at the time of European contact has been available for study. The historical changes that must have occurred during the long period that the islands were occupied before the coming of the Europeans have remained hidden from view. As a consequence, interisland relationships, population movements, and cultural diffusion—in short, the history of Polynesia has been rendered unduly difficult to establish.

Only in New Zealand has anything like historical depth emerged. Here the association of cultural remains with the bones of the extinct moa, a large flightless bird, provided the clue. The accumulation of data from a number of excavations, together with the careful appraisal of the Wairau site on the east coast of the South Island, has provided Mr. Duff with sufficient material to reconstruct a very cogent

Continued on page 287

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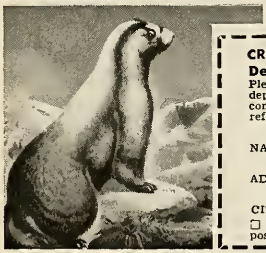

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▲ THE MAN WITH THE TROWEL: Dr. Jesse Nusbaum, who saw that science was to be dealt a serious blow. Irreparable damage could be prevented only if the bulldozers could be preceded by scientific diggers

BULLDOZERS vs. Trowels

A pipeline in the Southwest would benefit thousands of people, but it would also destroy scores of prehistoric sites vital to the reconstruction of man's past. Time was running out when one lone scientist challenged the juggernaut

By DEAN FREIDAY

LAST July 15, it was announced that construction would begin in two weeks on a 451-mile natural gas pipeline from Barker Canyon Dome in northwestern New Mexico to Topock, Arizona, in the Mohave Desert. This project would bring benefits to many communities, but in the same stroke, it was going to deal the science of archaeology a severe blow. A 60-foot right of way was to be cut through an area rich in prehistoric remains. Bulldozers and ditching machines would begin grinding up pit houses, kivas, even entire pueblos.

Forty-four years of familiarity with Southwestern archaeology had made Dr. Jesse L. Nusbaum aware of the damage that would be done. Apparently no one else was prepared to protect the prehistoric sites involved.

Amateur diggers used to be the major threat to prehistoric remains. Souvenir collecting was the main cause of damage. "Pothunters," unaware that digging into ruins for pottery or arrowheads disturbed the stratification that is essential to scientific excavation, had become such a menace that Congress passed in 1906 an Act for the Preservation of American Antiquities.

The Act restricted excavation on public lands to competent organizations, and it authorized the establishment of National Monuments for the preservation of areas of historic or prehistoric importance to the Nation. The Act was passed just in time to save the celebrated Pueblo Bonito from destruction, but the problem continued. Lack of policing outside of National Park Service areas and general unconcern for the damage being done made the Act only partially effective.

The development of large earthmoving machines and major construction projects multiplied the damage and loss alarmingly. Private landowners leveled most of the great prehistoric irrigation system developed on the desert floor of the Salt River Valley. Five prehistoric open-pit turquoise mines were obliterated during construction of Hoover Dam on the Colorado River, and scores of sites disappeared forever when the waters began to rise behind it.

Growing recognition of the emergent need for rescuing the valuable archaeological materials in sites destined to be flooded and lost behind the hundreds of dams that Federal agencies were planning and constructing throughout

Photos courtesy El Paso Natural Gas Co.

▲ THE HUGE ditching machine on the San Juan Project. When archaeologists became alarmed at the destruction this pipeline would cause, this machine was about to begin its 451-mile trench

➤ SWIFT LAST-MINUTE NEGOTIATIONS resulted in an agreement by the El Paso Natural Gas Company to permit the archaeological work and even to bear the cost. Here the bulldozer crew pauses to inspect the excavating of a Sinagua pit dwelling in Arizona before by-passing the site

the United States found expression in the formation of a government agency in 1945. This was known as the River Basin Survey. It was under the supervision of the Smithsonian Institution in collaboration with the National Park Service.

But the damage continued in other quarters. A contractor leveled a complete pueblo in the construction of U. S. Highway 66 in western New Mexico and used the material for road fill. Until the Secretary of the Interior intervened in 1939—following vigorous protests—road construction on Indian Reservations had been permitted to damage and destroy scores of archaeologic sites.

All these were of minor importance compared to what would be done in the construction of this pipeline. Bulldozers weighing 23 to 28 tons, which stop for nothing but solid rock ledges, would start on the long path across New Mexico and Arizona. One-, two-, and three-toothed rippers would rip and break up the softer rock formation and lift huge boulders so they could be bulldozed out of the way. A 37½-ton revolving wheel ditcher would dig 2 miles of trench every day—3½ feet wide and 6 feet deep.

No one could object to a pipeline that would bring added comfort to thousands of homes through cheaper fuel, but it was equally hard to condone the avoidable destruction of irreplaceable archaeological treasures. Dr. Nusbaum, personally, was in no position to require the company to conform to the Antiquities Act. Construction was to begin on the Navaho Indian Reservation, and for 218 miles it would continue on Navaho lands. Authority to grant right of way, therefore, and to issue the preliminary construction permit had been delegated to the General Superintendent of the Reservation and the Chairman of the Navaho Tribal Council. Dr. Nusbaum therefore urged the Navaho Reservation officials to make the request, and assured them that he would back them up.

The request was made, and on its receipt, an official of the El Paso Natural Gas Company objected strenuously to this last-minute interference by Dr. Nusbaum when construction was almost started. The company's primary concern was that the archaeological work would delay construction. Time was of the essence, and each day's delay would cost the company about $7500, or as much as several hundred thousand dollars if it prevented completion of pipeline construction in the high-altitude country before heavy snowfall.

When it was explained to another official, Mr. C. L. Perkins, Vice President and General Superintendent of the company, that the archaeological work would not interfere with the progress of the

Photo courtesy El Paso Natural Gas Co.

▲ In the path of the pipeline, 146 sites were discovered. The construction men became expert at recognizing the signs of ancient habitation. More than once when the markers blew away, they knew enough to avoid the spot

▲ A ruin the pipeline discovered. Careful mapping of the buried buildings is an essential pipeline and that costly diversions would be kept to a minimum, it is a tribute to Dr. Nusbaum's diplomatic skill that the company agreed to allow the scientific work to be done in advance of construction. It is also to the company's lasting credit that it offered to bear the cost of this work. Earlier the company had agreed to shift the route south of the Hopi villages to avoid as many sites as possible. Chairman Sam Ahkeah, of the Navaho Tribal Council, and General Superintendent Harper, who approved the right of way across the reservation lands, were glad to leave it to Dr. Nusbaum's discretion to decide where the route should be further shifted to avoid ruins.

Now that the scientific work had been approved and the funds provided, the real difficulties began. An accelerated archaeological technique had to be worked out. Excavation is a slow, meticulous procedure in which each layer is carefully removed and the exact position of each object and structural feature recorded, so that its relationship can be reviewed even after the work has long been completed. Obviously full excavation had to be limited. Dr. Nusbaum was not so concerned about the damage by the ditching machine, for it would make a trench neither wide enough nor deep enough to obliterate more than a slice through a whole village or even a house. Most important was adequate excavation of the shallow sites that would be completely destroyed in bulldozing the 60-foot swath.

Two crews of two archaeologists each were assembled, and Fred Wendorf, a fifth man, was appointed supervisor. He was to manage the work of both crews and to help the crew that most needed it as the balance of the work shifted. This division was necessary, because the pipeline was constructed by 2 "spreads"—2 complete assemblages, each composed of about 300 men, 1000 tons of self-propelled and portable construction equipment, warehouses, repair shops, offices, and even airstrips. The company also provided air transportation for Dr. Nusbaum when his assistance or advice was necessary.

A surface survey was first made

Courtesy LIFE

part of modern archaeological excavation. "Sidewalk superintendents" watched even in the desert

Photo courtesy El Paso Natural Gas Co.

▲ POTENTIALLY MORE DESTRUCTIVE than the trenching machine were the bulldozers, which first cleared a path 60 feet wide. The trencher cut only 3½ feet wide and 3 feet deep by each archaeological crew. As soon as the right of way was staked, the crew walked ahead to determine what was in the path of the line. They covered up to ten or eleven miles a day, with eyes alerted for scattered potsherds, broken artifacts, surface evidence of structures, or the slight bowl-shaped depression that marked an underground house or kiva if wind-driven sediments or alluvium hadn't filled it. Since the bulldozers could also clear and grade ten or eleven miles of right of way a day in very favorable terrain, the crew often felt that the machines were juggernauts riding their heels. On several occasions, the archaeologists had just finished making the last measurements and photographs when the bulldozers arrived. It was a standing joke on the job that if the men didn't get their archaeological work done in time, they would themselves become archaeological material.

They recorded site locations on the survey sheets and indicated the evidence of type and age as told by the artifacts, together with any information discovered by sinking test pits where desirable.

They followed up the pipeline ditching machine and examined the trench walls for archaeological or geological profiles. Where a site had been hidden by volcanic ash from Sunset Crater, or by other detritus, it was revealed in the trench walls. In no case did the ditching machine cut deeply enough to disturb the floors of pit dwellings or kivas where the important archaeolgical material was likely to be found, and in only one instance did it cut through the floor of a small pueblo, buried under windblown sand. The scientists made measured sketch plans wherever structures could be observed.

The work was not without its hazards, as rattlesnakes frequently fell into the trenches; and when they were unable to get out, they were in a very unfriendly mood.

Only once was the pipeline actually diverted from its planned course to avoid an important site. In the balance of cases where remains were encountered, the sites were excavated on the spot. Even the bulldozer operators, accustomed only to look down upon the earth from their powerful perches, became interested. The archaeologists were surprised to see them examining the ground with unaccustomed minuteness. And several times when the markers that had been posted to indicate a valuable site had blown away, the operators of the big machines had learned enough to recognize the indications of "pay dirt" and took care to clear only part of the path. Wherever major excavation was necessary, the company furnished all the extra labor needed for the heavy work.

The company was not legally obliged to submit to archaeological supervision on the non-Federal lands within the right of way, but as the construction progressed, the importance of the scientific work became increasingly apparent and the company agreed to extend the coverage. It also contributed the funds necessary for the proper study of recovered materials and for the preparation of the scientific report on the results of this program. The Museum of Northern Arizona has agreed to publish this report.

The number of sites encountered was surprising—146 in all, 52 in New Mexico and 94 in Arizona. Of these, only thirteen were fully excavated. Beyond their sheer number, what did these sites mean?

Along Willow Creek, 50 miles west of Seligman, Arizona, 10 sites comprising more than 30 structures were located in an area whose archaeology had previously been unknown. Time range of the houses excavated extended from Basket Maker III, A.D. 500-700, to the post-Columbian Navaho hogans whose floor debris was also excavated.

Surface finds of Pinto-Basin-like artifacts dating back to 4000 B.C. were made, but unfortunately no structures were found underlying these. Five prepottery sites (before A.D. 500) were located. These yielded the earliest material along the route.

We know that man existed in the Southwest as early as 10,000 years ago, from a fairly clear series of sites not connected with this project. The farther back we go, the fainter the picture. Occasionally archaeologists discover a little additional evidence on this early period. Proper surveys, like the present one, may help locate that evidence. Only in this way can the danger of loss through unscientific excavation be averted.

A relatively rare type of site is one that reflects the lives of two different groups of people. It acts as a connecting link and demonstrates clearly the interrelationships between the cultures. Ten sites of this type were found by this survey, sites that were common to Colorado Plateau Cohonino and Colorado River Valley Patayan—two cultures, by the way, whose existence was unknown twenty years ago.

The pipeline survey had geologic value as well. In one place, the trenching machine cut through a sand dune, exposing five horizontal bands of caliche interspersed with equal or thicker layers of clean sand. This was clear evidence of five wet and five dry cycles, with many implications for the effect on human and plant life during those periods. According to Dr. Nusbaum, the critical fluctuations in water supply and their influence on the migrations of people have been one of the most important factors in the prehistory of the Southwest.

During the years of adequate water supply, the dry farmers of the area prospered. Their principal crops were corn and, in lesser measure, beans and squash. These they supplemented with limited gathering of native plant foods and hunting.

A few seasons of diminishing water supply would force them to seek more favorable situations. They became prodigious builders —and apparently built new dwellings wherever they moved.

There was only a limited number of locations where ideal year-around conditions existed. The

Continued on page 288

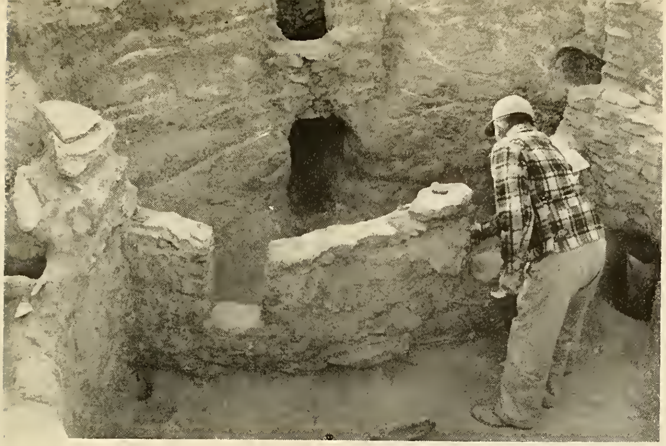
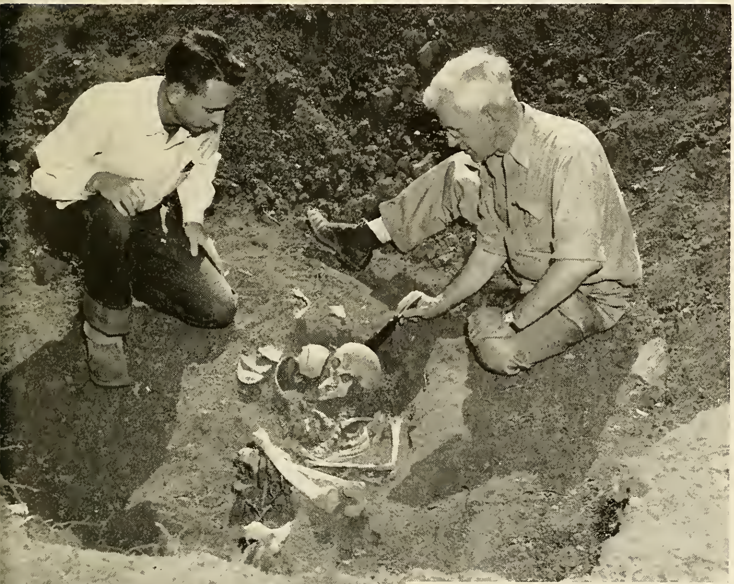


Photo courtesy El Paso Natural Gas Co.

◄ A TYPICAL Mesa Verde type kiva or ceremonial room of the Pueblo II period. It was deeply buried beneath wind-blown and water-borne material during the nine centuries since its use, so that the bulldozer only revealed its topmost wall. Note the outside flue and interior fire pit, separated by a low deflector wall with dual passageways

Photo courtesy El Paso Natural Gas Co.

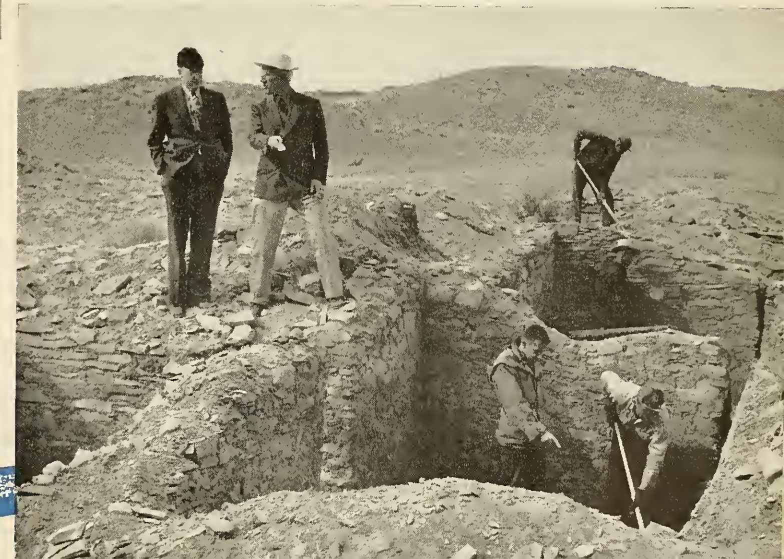
▲ SOMETIMES the pipe skirted a buried dwelling, but it never caused serious damage. This Basket Maker III house of two chambers was occupied about 1300 years ago. No signs of it showed on the surface, for three feet of soil had accumulated above it during the intervening centuries



Courtesy LIFE

▲ DR. NUSBAUM and assistant brushing the dust of ages from the head of a primitive Indian

Photo courtesy El Paso Natural Gas Co.



► A LARGE RUIN of the early classical Pueblo III period, 114 feet by 74 feet. Above, Dr. Nusbaum is explaining excavation to a Company Engineer. Below, Francis Cassidy is discussing the job with a Caterpillar Foreman, who begged to be left on the archaeological work at $1.15 an hour rather than receive the regular $2.95, because he had never had the chance to search for ancient man

Centuries of abuse have brought our soils to the verge of ruin. The need

natural resources finds expression in the new Felix M. Warburg Memorial Hall, recently ope

Build a Healthy Acre

To most people the term "ecology" is a sixty-four-dollar word that conveys little meaning. Actually its significance is comparatively simple. It means the relationship of plants, animals, and people to their environment and the alterations that occur in the environment from time to time through changes of season, rainfall, climate, and the influence of man himself. It is a science, and basically even a philosophy, which in the past has received too little attention in our whole system of education. It is basic because only out of the proper understanding of man's relationship to his surroundings can he eventually achieve health, prosperity, vigor, the means of relaxation, and indeed not only peace of mind for himself but peace with his neighbors. It is not too broad a statement to say that if the whole of the world were established upon a base of proper ecological understanding, the occasions for wars would be greatly diminished or even eliminated.

The new Felix M. Warburg Hall at the American Museum of Natural History is dedicated to ecology, and it is, so far as I know, the only exhibit in the world with ecological understanding as the basis of its conception. The Hall was made possible by members of the Warburg family as a memorial to that great philanthropist and citizen Felix M. Warburg. It was planned and carried through by Director Albert E. Parr and his co-workers on the staff of the great museum.

Both broadly and in the minute details, the greatest care has gone into the execution of the plans, for the over-all picture it creates is significant and the small points that contribute to making up the whole are vivid and challenging to either a school child or a distinguished scientist. Wisely Dr. Parr did not take the whole of the world or even of a state or a county as the base of his exhibit. He limited its borders to an area of 40 square miles around Pine Plains in Dutchess County, New York. It is significant that the area chosen for the exhibit is within easy distance of New York City itself so that an individual or school group may attend the exhibit, study it, and then in turn pay a visit to the Pine Plains area itself.

The treatment of the exhibit and its presentation are completely modern in approach and embody many new developments in museum presentation technique. Some of these, including the skillful use of reflecting mirrors to achieve depth and proper lighting in whole landscapes, have been worked out by Dr. Parr and his museum staff assistants. The results are remarkable.

The whole is presented in an understandable and interesting fashion, clearly but with no concessions to popular vulgarity. The captions for the exhibit and the individual texts are clear and simple. The new Hall is, indeed, a model of the whole new technique in presenting museum material, far removed from the old mud colors, the dust, and the obscurity of over-Latinized and too-scientific presentation.

The Pine Plains area chosen for study and presentation is pictured at the entrance to the Hall by a huge landscape showing the rich variety of the countryside. There are the swamps and marshes, the agricultural land, the ledges of decaying shale and granitic rock, the mounds of glacial till, the potholes, forests, undergrowth, and wildflower vegetation. From this over-all presentation, one progresses to the various exhibits in which the whole of the pattern of plants, animals, and people existing within that given area is broken down into detail, as if bit by bit the spectator were taking apart the landscape and examining it under a heavy magnifying glass or even a microscope.

Notable among the first stages of the breakdown is a series of five

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[*] Louis Bromfield is well known as a winner of the Pulitzer Prize and the author of 30 novels and other books. He is also one of our country's foremost exponents of good land use and a leading figure in the application of wise conservation in his own state of Ohio and elsewhere. On May 14, he gave an address at the American Museum of Natural History on the opening of this Hall.—Ed.

new national philosophy regarding

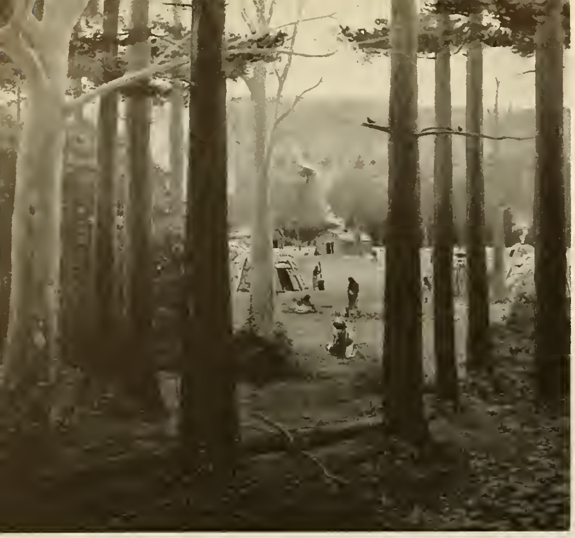
the American Museum

By Louis Bromfield*

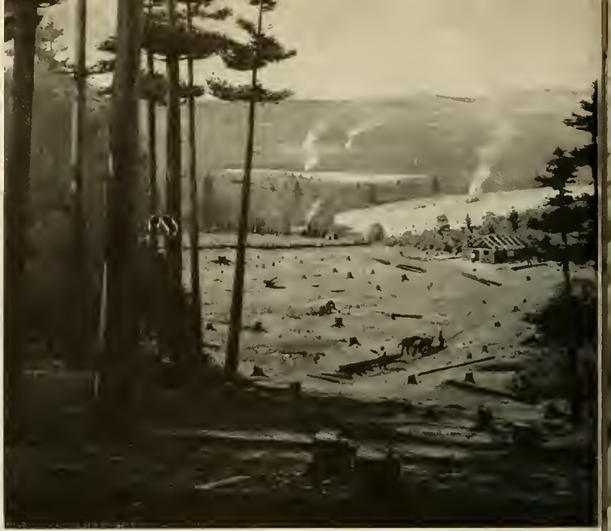
large panels showing the broad external picture of the forty-square-mile area at five stages of its development. The first of these shows the Primeval Forest, inhabited only by wild creatures and the half-wild Indians. The second shows the coming of the first white settlers in 1790. The third is the landscape in 1840, when the land has been cleared of forest and put to agriculture, with the abundant returns of freshly cleared virgin soil, undepleted and unspoiled by the hand of the white man. The fourth (1870) represents the beginning of the decline in fertility under an agriculture that took everything and returned little. Soil erosion and floodwaters were beginning to be disastrous, and the forest had begun to creep back, taking over the partially depleted fields with scrub and second-growth timber. The fifth panel represents the same landscape in 1950, when a whole new frontier is being established in which the pioneer's task is no longer the battle with Indians and the clearing of the forest but the restoration of the land damaged or ruined by the first tide of white man's management.

These five panels have a significance far beyond the limited area around Pine Plains, for they symbolize the history of the white man's invasion, exploitation, and destruction of natural resources throughout the whole country—perhaps the worst and most reckless example of

Entrance to
Felix M. Warburg Memorial Hall



The Primeval Forest



The Settlement 1790

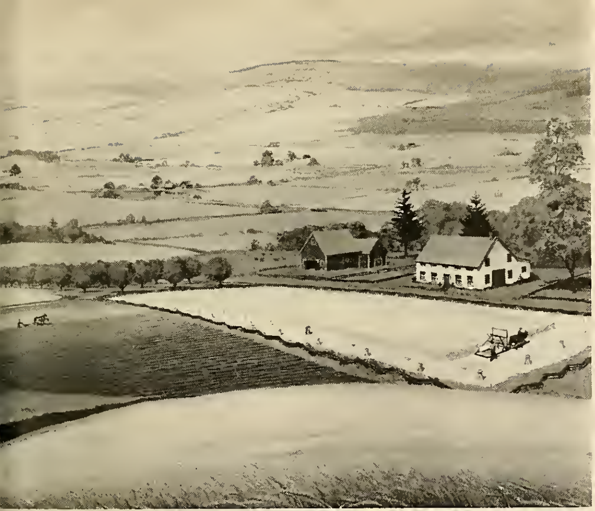
exploitation and destruction ever achieved by any nation at any period of history. They are a superb example of how man, through his lack of understanding of environment and nature, can endanger or destroy the very basis of his health, prosperity, and general well-being. The fifth panel, representing the area in our own day, is encouraging and even optimistic in tone. It shows how, through proper understanding of ecology, man can restore and rebuild a whole area to its old level of production and fertility and even create an abundance greater than that produced by the area when the first men put it to the plow.

The first panel shows a kind of sylvan paradise occupied by the Indian who lived by hunting and the cultivation of corn, beans, and squash in an opening in the forest. The natural cycle of birth, growth, death, decay, and rebirth is scarcely disturbed at all, and the Indian himself is very nearly a wild creature. The third panel displays the same landscape after the white man has cleared away the forest and divided the area into square fields. Here he is reaping and destroying the abundance born of millions of years of birth, growth, death, decay, and rebirth, which the deep, rich topsoils represent. In the fourth panel are shown the ravages of greed and of the ignorance of natural laws upon the same landscape. It is already on the downgrade toward abandoned pastures, and the once fertile fields are being taken over again by the scrub growth of a returning forest. The fifth scene represents the beginning of the renaissance of the same landscape, with contoured fields and legume and grass crops, managed forests, and modern power machinery.

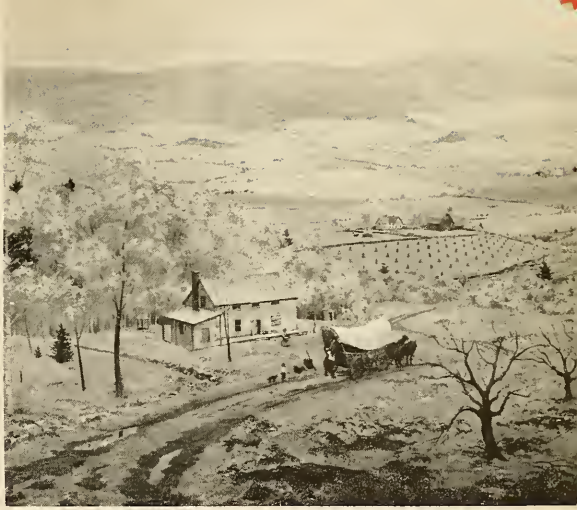
The five panels tell a striking story of what has happened and is happening to the whole of the nation; but above all, they depict the disaster that can overtake man when he ignores natural law, in contrast with the great blessings that can accrue when he understands and works with it. In an area badly exploited, the wildlife begins to disappear; the streams flood and turn muddy and in summer do not flow at all; the livestock grows bony and weak and nonproductive; the farmer and his family grow poor, both economically and physically; and the people living in remote cities begin to pay higher and higher prices for food of increasingly poorer quality.

In fact, the whole of the new Hall should be of greater interest to the city dweller than to the villager or farmer, for it dramatizes the relationship and the remote but fundamental dependence of the city dweller—so remote that he sometimes does not recognize it—upon the whole of nature and upon natural resources for his well-being and indeed his very existence.

Beyond these five striking panels depicting development of the Pine Plains area, the region is again broken down into smaller segments. These reveal the relationship of living things, both plants and animals, to the soils and to the climatic conditions in which they exist. Some of these exhibits are striking in their verisimilitude, both in regard to the physical conditions and the plant and animal life. Segments of various soils have been removed by special techniques without disturbing in any way the exact pattern in which they were laid down by either glaciation or weathering and decay. It could be said that in truth the spectator goes underground and becomes a field mouse, chipmunk, mole, or yellow jacket. One becomes aware of the intense and compli-



The High Tide
1840

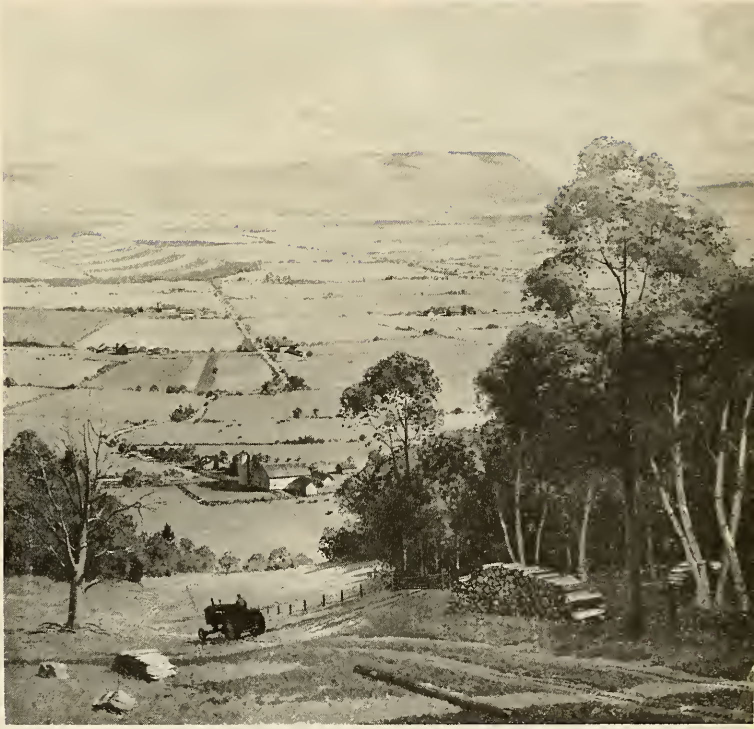


The Ebb
1870

cated life going on underground, which even the more experienced nature lover may sometimes ignore.

This is the summer underground nest of the yellow jacket, which in winter becomes the cozy home of the white-footed field mouse. One sees the humble earthworm working near the surface in the warm summer months, devouring the decaying leaves and grass and converting them into rich soil. One sees him buried and dormant during the winter months, far below the line where frost penetrates. Then there is the chipmunk sleeping through the winter in his warm and comfortable nest. One sees the leaves and the nuts he has gathered, partly to build his nest and partly to use as food if he wakes a little early in the spring and discovers that outside the food is still scarce. There is the complex metropolitan underground habitation of an ant colony. And, of course, unseen but noted, is the immense population, measurable only in trillions, of the benevolent bacteria, which are constantly at work converting what remains of dead animals, leaves, and twigs into the rich soil which in the end feeds all the life that continues.

One of the most striking exhibits



Today
1951

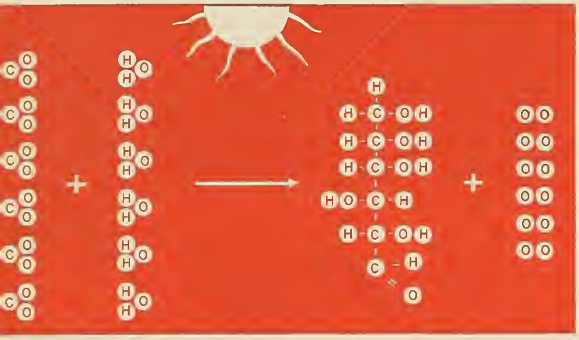
Cycle of Nutrition and Decay

One of the many subjects presented graphically in the new Felix M. Warburg Memorial Hall at the American Museum

PHOTOSYNTHESIS and RESPIRATION

▼ SUNLIGHT shining on the green coloring matter in plants (chlorophyll) allows carbon dioxide and water to combine to form a molecule of sugar, in which energy is stored. This process, called *photosynthesis,* occurs only in green plants

▼ IN THE reverse process of *respiration,* the sugar is burned, giving off energy and leaving the inert substances—carbon dioxide and water—with which the process started. Respiration occurs in all plants and animals



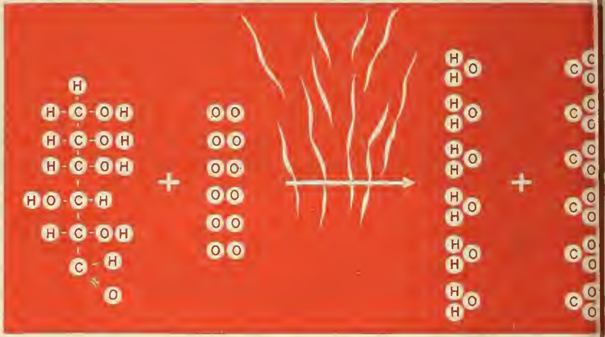
RBON DIOX- E molecules—O_2 (Two atoms oxygen to one carbon)

WATER MOLECULES — H_2O (Two atoms of hydrogen to one of oxygen)

SUNLIGHT

SUGAR MOLECULE containing 12 atoms of hydrogen, 6 of oxygen, and 6 of carbon

12 ATOMS of oxygen left over as a by-product



A MOLECULE of sugar

COMBINING with oxygen

BURNS — releasing the energy in the sugar as heat or power

THIS PROCESS yields carbon dioxide and water as by-products

Fertilizers in the Soil

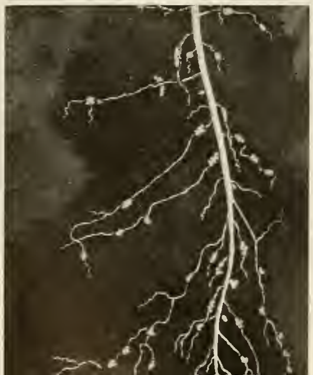
IN THE AUTUMN, man takes crops away, and unless he makes replacements of some sort, the soil becomes poor and useless. He adds commercial fertilizers such as phosphate, nitrates, and potash, or he may grow clover and alfalfa which he plows back into the soil. These plants have root nodules containing nitrogen-fixing bacteria, which take nitrogen from the air and turn it into usable nitrates

NITROGEN-FIXING BACTERIA

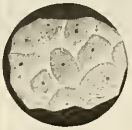
BACTERIA enter the roots from the soil and establish themselves in cells in the root tissues. These cells become enlarged, and finally nodules are formed. The enclosed bacteria fix nitrogen into nitrates. These are released into the soil when the roots decay

◄ RED CLOVER plant

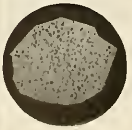
▼ ENLARGEMENT of Root Nodules



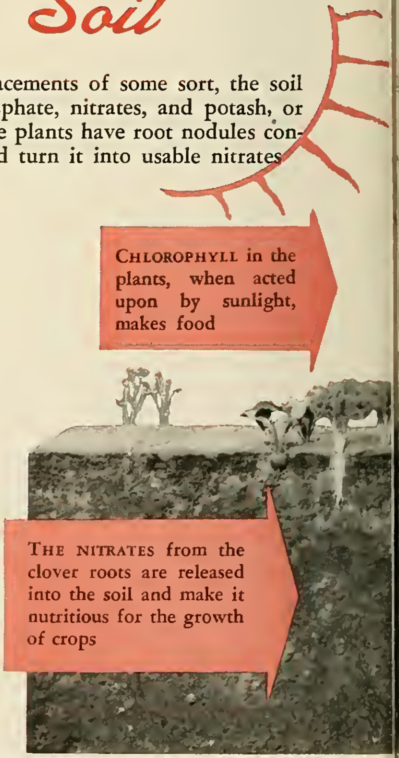
◄ ONE NODULE, magnified



◄ ENLARGEMENT of cells in a nodule



◄ BACTERIA within the cell, further magnified



CHLOROPHYLL in the plants, when acted upon by sunlight, makes food

THE NITRATES from the clover roots are released into the soil and make it nutritious for the growth of crops demonstrates why, once land comes under intensive cultivation and the products are removed and used or consumed elsewhere under a heavy drain, the natural balance of things becomes upset. It shows why it then becomes necessary to introduce into the soil quantities of fertilizing material, both mineral and organic, to maintain the fertility that provides the means of life for all plants and animals and the means of economic prosperity for man, both in the country and in the city.

In addition to the five vivid panels mentioned earlier, the Hall also contains a relief map of the area made to scale, with farms, wood lots, and roads represented. One of the best touches is the use of a good modern automobile map of the area, which any citizen, through familiarity with such maps, can read and understand quickly and thoroughly. It is one of the modern touches and an extremely intelligent one.

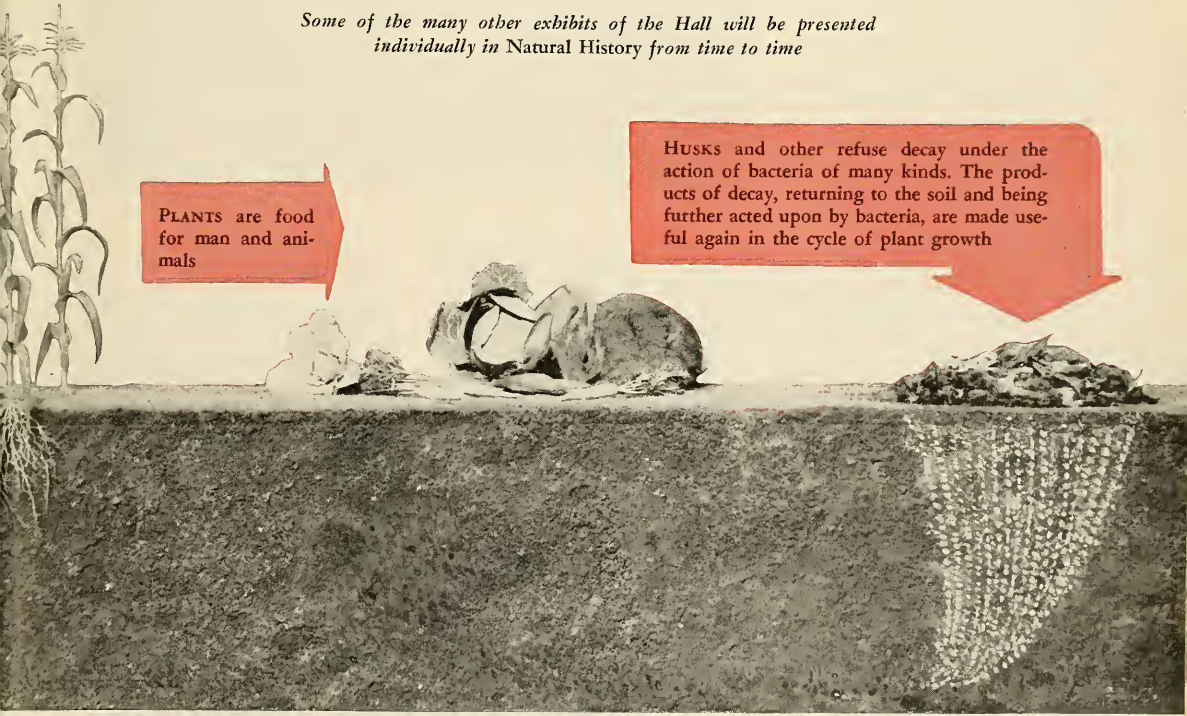
It is quite impossible within the limits of a single fairly brief article to cover all the exhibits in the new Hall, for they show with admirable clarity, detail, and simplicity the immense complexity and interrelationship of all living things. It is notable —and immensely so—that this is the first time that life, geology, paleontology, agriculture, entomology, and many other sciences have been represented in such a clear, comprehensive, and comprehensible fashion.

The exhibit showing the length of time involved in the formation of various layers of soils and rock is not only informative but fascinating to any mildly inquiring mind. You see the soil and the layers which represent, according to the circumstances, hundreds or thousands of years in their formation. Nothing, save perhaps the cross sections of the giant sequoias and redwoods in the adjoining forestry exhibit, can be so good for the superheated ego and reduce to the proper level of its essential insignificance the political nonsense of our times or the worries and preoccupations of the average man or woman.

There is an admirably clear chart and demonstration of the workings of photosynthesis and respiration, so far as we understand them, in the cycle of food, nutrition, and decay. Another similar exhibit deals with the workings of the legume family and its accompanying nitrogen-fixing bacteria in the renewal of the soil.

Here in the new Felix M. Warburg Hall one might almost say that the workings of the life principle are all set forth, that one comes very close to an understanding of why man and even life continues to exist and carry on despite frightful obstacles. The whole of the exhibit tends to produce a sense of awe, even of that religious feeling experienced by any true scientist with an uninhibited mind. But best of all, the new Hall puts all of the knowledge within the reach of the man in the street and the growing school child, in terms that are accurate, vivid, and interesting. Altogether the new Hall is a very great accomplishment and a very great step forward in museum technique and education. The public and the nation should be deeply grateful to the Warburg family and to Dr. Parr and his associates in this new accomplishment. It is truly a great show.

Some of the many other exhibits of the Hall will be presented individually in Natural History *from time to time*



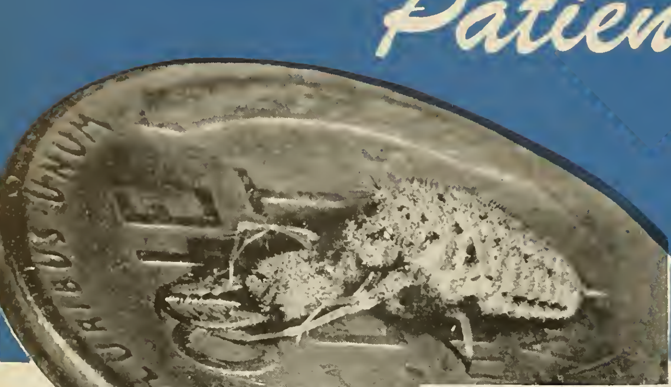
Plants are food for man and animals

Husks and other refuse decay under the action of bacteria of many kinds. The products of decay, returning to the soil and being further acted upon by bacteria, are made useful again in the cycle of plant growth

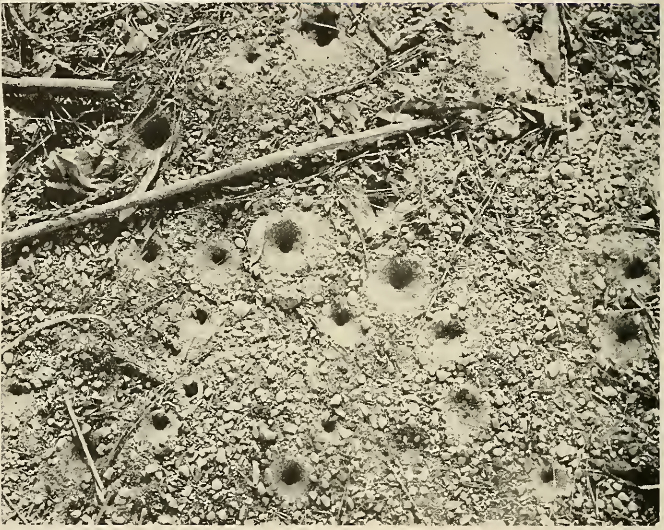
Patience Rewards

The tiny funnel-shaped traps you have se

but within their dark confines are



➤ THE STRANGE humpbacked creature that constructs this astonishing pitfall is equipped with jaws like hypodermic needles, which inject a powerful insect poison. The penny shows relative size



➤ IT IS NOT hard to find the pitfalls of the ant lion and to observe the insect at work. The ant lion normally lives in dry situations almost everywhere from your back yard to the Sahara Desert. The pitfalls are often found under ledges, eaves, etc.

IN nature there are many ways of making a living, just as there are with human beings, but some of the methods that animals have invented are far stranger than fiction. Take the case of the ant lion. Who would believe it possible that any creature could live and grow fat merely by excavating a pit in the sand and hiding in the bottom? Yet, this is the established way of life for the ant lion.

Almost everyone has seen the tiny pitfalls of these interesting creatures in dry sandy or dusty places, but few know much about the insects themselves.

In the first place, an ant lion has plenty of time. If it hadn't, its way of life would not work. It often has to wait a long time between meals, but it is well adapted to such vicissitudes.

To start at the beginning, the ant lion is a small insect approximately a third of an inch long, with six weak legs and a small head with two sickle-like jaws extending forward. One of the first things one notices about the ant lion is that it can walk only backward, and this is the mode of progression it employs in excavating its small pitfalls. When it has selected a site that seems to offer advantages from the standpoint of the ant lion, it begins to back through the sand and at the same time tosses the sand in the air by flipping its head upward. This process of backing into the sand until it is nearly covered and then tossing the sand out with its head continues in an ever-narrowing circle; and when the center is reached, a neat pit has been formed with nicely sloping sides.

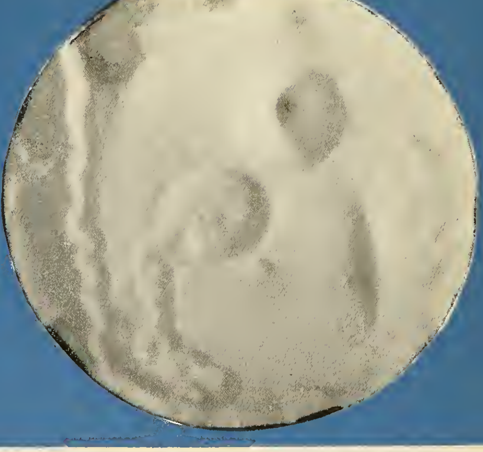
Now, as often happens, the spot at which the ant lion chooses to dig may have a good many small pebbles mixed with the fine sand. This poses a problem to the pit digger but one that it can handle. The method that the ant lion uses to

The Ant Lion

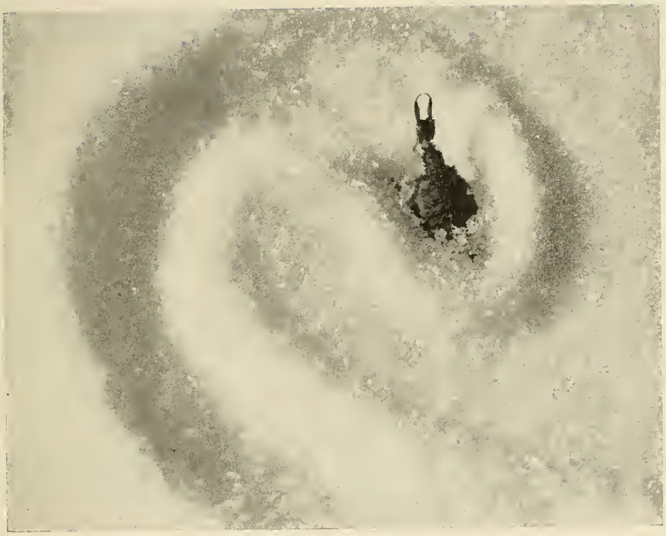
the dry sand may look innocent,

s of the ant lion, ready to assassinate any luckless victim

By Ross E. Hutchins



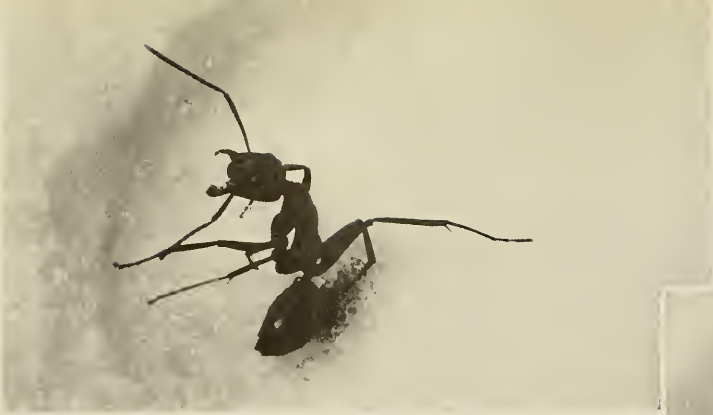
▲ THE ANT LION can easily be induced to dwell in a dish of sugar, where it is easier to observe the insect. Note the zigzag trail of one ant lion leading to an unfinished pit. Just beyond is a completed pitfall with an ant lion concealed at the bottom



◀ THE ANT LION begins by making a circle and then continuing to work toward the center, tossing the sand out with its head and jaws. It then conceals itself at the bottom and waits for whatever fortune may bring. Ant lions have been known to live at the bottom of their pitfall for three years waiting for prey

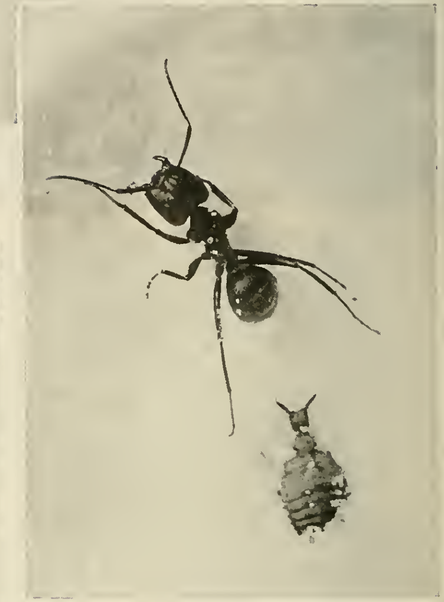
▼ AN ANT comes near the edge. The soft sugar begins to give way, and the ant lion begins to toss particles into the air to knock the ant in

remove pebbles too large to be tossed out with its head was described by a French entomologist in the early 1800's but was questioned by later scientists until careful experiments were made in 1907 by H. C. McCook, whose observations follow: "Three pebbles, all larger and heavier than the ant lion, were dropped into the centre of a pit where they would be most inconvenient to the occupant and likely to prompt her to remove them. The ant lion thrust its head beneath a pebble and tried to toss it from the pit. Having failed in this, it tried another mode. It placed the end of its abdomen against and



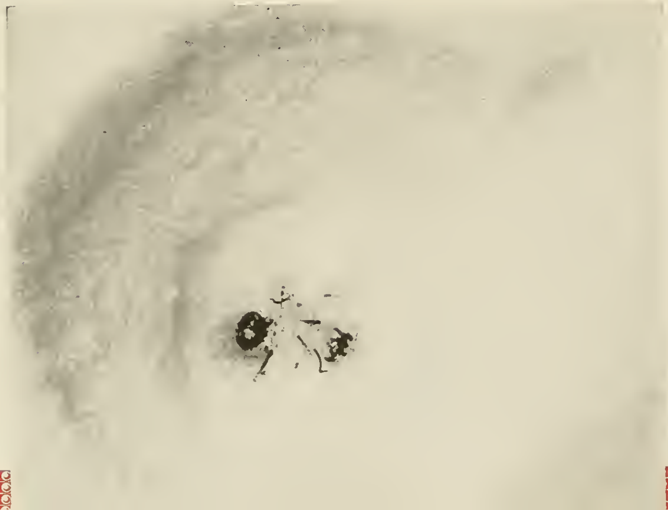
◄ **The ant** tumbles into the pit on top of the ant lion

▼ **The ant** tries to scramble out, but the ant lion pursues it and . . .



▼ . . . drags the ant back into the bottom of the pit. The poison that the ant lion has injected into the ant has already taken effect

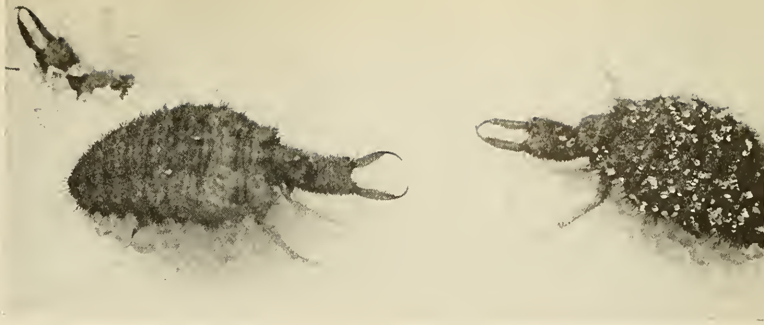
▼ **The ant** is being dragged beneath the "sand," where the voracious ant lion will digest it at leisure



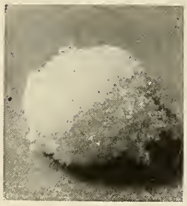
a little beneath a pebble and began to push backward. A little time was taken to adjust the pebble so that its centre of gravity would be against the end of the body. Then the animal began to back up out of the pit. All of the three pebbles were thus removed." Thus, the correctness of the early observations was confirmed.

These pitfalls vary with the size of the occupant, but they probably average about two inches across and perhaps half that in depth. When completed, the pit is round with smooth sides; and the ant lion then takes up its position concealed in the sand at the bottom. It waits.

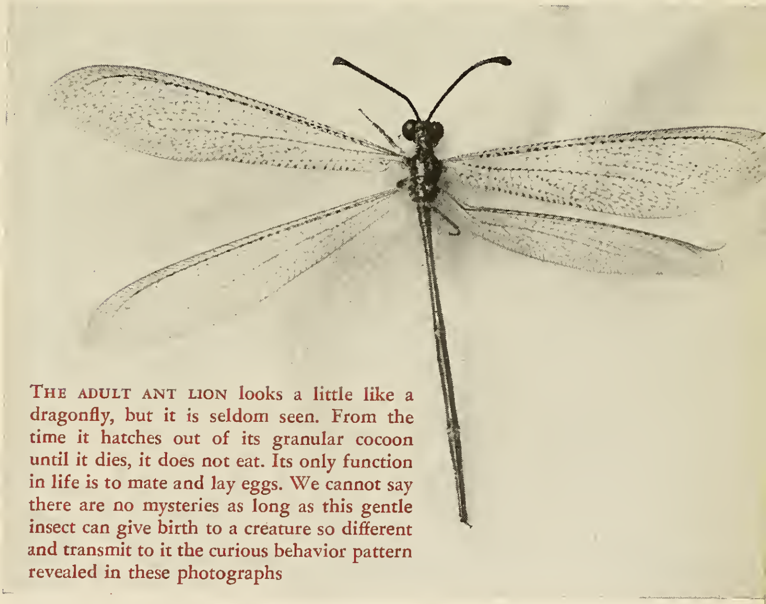
An hour passes, a day passes, perhaps many days pass. Just how long the insect can wait is not known, but eventually its patient vigil pays off. An ant or other small creature wandering about acci-



▲ When ant lion meets ant lion, only one is apt to leave the spot, for they are cannibalistic. The third individual in the background is backing into the "sand"



Cocoons of the ant lion. As astonishing as the skill of the ant lion in constructing its trap and capturing its prey is the fact that it transforms into a totally different looking creature. The cocoon on the left was constructed of sugar grains, while the one on the right was built of sand and in natural conditions. Out of these cocoons will come the gauzy-winged adult insect



The adult ant lion looks a little like a dragonfly, but it is seldom seen. From the time it hatches out of its granular cocoon until it dies, it does not eat. Its only function in life is to mate and lay eggs. We cannot say there are no mysteries as long as this gentle insect can give birth to a creature so different and transmit to it the curious behavior pattern revealed in these photographs

dentally falls into the pit. It tries desperately to climb out, but the shifting sand makes escape difficult. After a mad scramble, it seems almost on the verge of escape when the ant lion begins tossing sand into the air. With the falling sand overhead and the shifting sand below, the luckless creature suddenly finds itself tumbling to the bottom of the pit. Before it can recover its footing, it is seized by the sickle-like jaws of the ant lion. These jaws are really hypodermic needles, and within a few seconds the captive is killed by the injection of a powerful toxin.

This toxin serves two purposes. In the first place it quickly kills the victim, and in the second place it has the remarkable power to digest or dissolve the body contents of the prey. Of course, this takes time but, as usual, the ant lion is in no hurry. It pulls its booty out of sight under the sand at the bottom of the pit and waits for the poison to do its work. After a time, it begins to suck the nutritious juices through the same hollow jaws into its own stomach, until all that remains of its erstwhile prey is a shriveled carcass, which it tosses out of the pit.

Among the other "believe it or not" characteristics of the ant lion is the fact that the intestinal canal is incomplete. In other words, this insect voids no excrement during the stage of its life that is spent in the pitfall. Another interesting thing is its ability to "play 'possum." If you pick one up with a pair of tweezers, it will usually appear to lose all signs of life, but when placed back on the ground, it will soon "come to life" again and go on about its business.

The life cycle of the ant lion is much longer than that of most insects, due to the intermittent nature of its food supply. It probably requires from two to three years to reach the adult stage. During this period many vicissitudes may overtake it, and it may move its pitfall many times. The ant lions shown in the accompanying photographs were collected in an area that is under floodwater to a depth of several feet each winter. Yet when the waters recede and warm weather returns, there are the tiny pits set up for business as usual. Truly, nature takes care of her children.

When, in spite of the irregularity of meals, the ant lion becomes a full-grown larva and is ready to transform to the winged form, it is faced with further complications. When the average caterpillar or other larva spins its cocoon, it

Continued on page 288

▲ ON RIDGE TRAIL visitors can see a woodland typical of what early settlers found when they pushed through to open up the Old Northw

Forest Remnant

The early colonists found a new way of life in majestic groves like those in the Cook Forest State Park. In all the Northeastern States, few primeval tracts like this can still be seen

By HELEN FAYE

Photographs by the author

IN western Pennsylvania, a great steel-producing center and a remnant of primitive American wilderness stand almost side by side. Ninety-two miles north of Pittsburgh, great pines and hemlocks reach toward the sky in Cook Forest State Park. Cook Forest is one of the few remaining areas that bear a likeness to the Great Forest that once swept majestically across one-third of the Continent. Some of these very trees were approaching maturity when John Cabot sighted the green line of the western horizon in 1497. Today, this remnant of the old forest looks much as it did almost 1000 years ago when Leif Ericson came to Markland (Land of Forest) and is said to have returned to Iceland with beams of maple.

A chance remark led to our own discovery of this portion of ancient wilderness. We were showing photographs of the pine forests of California's Sierra Nevada to friends. One of them exclaimed, "Why, we have trees that look like that right in Pennsylvania."

A little skeptically, we followed her directions to Cooksburg, a tiny village on a bend of the Clarion River. This river lies in a deeply dissected area near the western edge of the Alleghany Plateau. The Park headquarters is in Cooksburg, and at the doorstep of the ranger's office the dense stands of timber start their climb up the steep slopes of the hills to the top of the plateau. The Park covers 6000 acres, much of which has been untouched by man except for the building of trails. No serious fire has ever raged through these hills and ravines. The lumberman came close but spared the greatest trees.

Our skepticism had vanished by the time we found our way to the Forest Cathedral (so marked on the Park map). Here, in a natural amphitheater in the hillside, we stood among pines that towered 200 feet above us. The sound of the wind in the branches, the patches of sunlight, the deeply fissured bark of the old trees—many of the sights, sounds, and scents of the Forest Cathedral were indeed reminiscent of the forests of our western mountains.

Perhaps as exciting as the beauty of this place was the knowledge that we stood gazing on the same America that this nation's forefathers had seen. In 1607, when Jamestown was founded, the Great Forest of conifers and hardwoods stretched from the Atlantic to the prairies beyond the Mississippi. Indian clearings and savannas broke the forest in a few places, but the green canopy of trees was the dominant feature of the land. There were places where tangled vines and underbrush grew as dense as a jungle; in others, the soaring trees had cut out the sun so effectively that the forest floor was as clear as a park. In Cook Forest we found just such an impenetrable woodland, as well as natural clearings where the intermingled leafy crowns kept the sunlight from filtering through.

The great migrations that colonized the New World brought settlers to whom the forest meant food, shelter, and a way of life. They cut wood to build and to heat their homes. They trapped and hunted in the forest for food and skins. They often set fire to the trees as a quick way of clearing the land, and if the fires got out of control and roared away over the mountain, it was serious, certainly, but not a disaster. There was more wood and more land beyond the horizon.

On the heels of the pioneer settler came the lumberman. As early

▼ TALL HEMLOCKS like these grow along a trail in Cook Forest Park—only 92 miles north of Pittsburgh

▲ THE CLARION RIVER, as seen from the River Drive in Cook Forest

as 1630, New Englanders exported forest products to their homeland. When the British Navy was cut off from its Baltic sources of supplies by the Dutch Wars of the seventeenth century, England looked to her American colonies for planking and resin, for turpentine, masts, and spars. In the Southern Colonies, the pine barrens provided tar and turpentine. In the Middle Colonies and New England, white pine provided the tall, strong masts on which the Royal Navy relied, even as our modern navies rely on oil for motive power. These mast trees of the Northern Colonies became so important to the growth and maintenance of the Royal Navy that special agents of the King were sent through the forests to mark all trees that were suitable for masts. This mark was a broad arrow, signifying that the tree was reserved for the Crown.

The early colonists, mostly British in origin, had grown independent of the homeland. Because of their own hard struggle to claim the fruits of the frontier, they felt that this appropriation of the trees was arbitrary and that it denied them their self-earned rights. In order to control the lumber industry and ensure ample supplies for the navy, the British home government passed a series of regulations culminating in the Timber Act of 1727, which severely restricted the cutting and sale of lumber except to Great Britain. The resentment of the mercantile colonists against this law (which if fully enforced would have crippled their export trade) and the backwoodsmen's indignation against the King's timber agents were high on the list of "tyrannies" that provoked the Declaration of Independence.

The eastern United States has since become a land of large urban and semiurban areas; of open farmlands and second-growth woods. Today an American looks almost in vain for a glimpse of the countryside the colonists knew. There are spots in steep ravines and on inaccessible slopes in the mountains of the East that the settlers and lumbermen passed by. But Pennsylvania's Cook Forest Park is probably the most accessible tract of virgin timberland in the densely populated northeastern United States. Buffalo, New York, is 147 miles away and Youngstown, Ohio, is only 88. New York City is a one day's drive to the east.

In the Forest Cathedral area, towering white pines and hemlocks sway above one's head. The trunks of huge trees lie rotting along the path, being reclaimed by the soil; and mosses, ferns, and mountain laurel cover the ground. Here we find the forest-grown Eastern White Pines, which resemble the famous mast trees of the British Navy. Each tree, forced by its neighbors to compete for the sunlight, has thrust its crown upward toward the sky. Their trunks are tall and wonderfully straight. They are not as large in diameter as those growing in more open places, and they lack the girth of the great trees of the West, but as one raises his eyes to their crowns, he can visualize these sturdy poles supporting white sails on all the seas of the world.

A good introduction to the Park is to hike along the Longfellow Trail, which leads to the big pines. Along the bottom land at the beginning of the trail, you pass through rhododendron thickets, bright with bloom in the spring. Tom's Run sparkles and races along here, and the ground is damp underfoot. The vegetation is luxuriant. Climbing the uphill trail, you hear a sighing, and above your head the pines are whispering in the wind. The mysterious faraway sound of the pine may actually be coming from trees only a few feet away, their fragile needles vibrating in the breeze. Ferns line the path; a tiny chipmunk darts away in alarm, and suddenly the forest is filled with sound. The drumming of a woodpecker is heard from faraway; a blue jay screams close at hand. A dramatic comedy unfolds before you: a red squirrel, chattering and scolding, is racing to the top of a thick beech, chasing

▲ THIS INTERESTING FORM is a hemlock snag that was probably struck by lightning

◀ A YELLOW BIRCH with multiple trunks. Cook Forest is an educational as well as a recreational region. Many large signs label the area you are passing through

▲ FOREST-GROWN Wild Black Cherry trees enhance the beauty of the area near the Ridge Camping Area

a brother along impossibly fragile twigs, flying through the air from branch to branch. Finally, having routed his opponent, he rests above your head and rasps his nagging chant of victory.

The scent of the pines, distilled by the sun and distributed by the breeze, floats down to you. A flash of color reveals a warbler darting through a patch of sunlight. At some moments these woods are alive with birds. You come to the upturned base of a fallen giant; pale green ferns are growing in the earth-laden roots; moss covers the rotting log. Farther along the trail you see motion, and a glossy-coated black squirrel pauses in alarm and then flees silently, avoiding each dead leaf, each twig that might reveal the route of his escape. Now, in the Forest Cathedral, you lie on your back with pine needles for a pillow and gaze up at the pine tops swaying in the wind. It is amazing to see the massive, sturdy tree beside you bend like a reed so far above your head.

Again following the path, you leave the stand of pure pines and hemlocks and find yourself walking among oaks and maples. The shining green leaves of mountain laurel contrast with lacy, young hemlock trees. In the distance, the silvery bark of a beech tree gleams in the dark forest.

To see a woodland typical of those the settlers pushed through in opening up the Old Northwest, you must visit the deep woods behind the Ridge Camping Area of the Park. The Camp Trail leads the visitor through primeval hardwoods: beech, oak, the silvery spires of blighted chestnuts, and a few virgin cherry trees, soaring over 100 feet, mingle with the ubiquitous hemlock. The dense thickets of fallen trees and underbrush in woods of this kind must have made hard going for men who hewed each path with an ax. You can almost hear the creak of their wagons, loaded with furs, freight, or household goods. This, too, is the place for one to see wildlife. A ruffed grouse may suddenly catapult from his hiding place to cross your path with wingbeats sounding like thunder.

Another primitive area of the forest is the Virgin Hemlock, a dense and swampy thicket with occasional natural clearings. If you find yourself following a narrow trail in this area, it will be one made by deer, for there are no man-made pathways here. The southern end of the Park is well traversed by 20 miles of footpaths, but there are also large areas without trails or roads, where the adventurous person may make his own way.

Cook Forest borders the Clarion River, which meanders in deep, lazy curves for seven miles along the Park boundary. The river road is an excellent place for a walk or drive after dark. We saw porcupine, opossum, skunk, raccoon, and a meadow full of browsing deer along this road at night. Cooksburg is located on the river, and in addition to the Park Office there are a grocery store, post office, gas stations, and several inns and cabin groups.

The State maintains housekeeping cabins and camp sites within the Park, and others near by are privately owned. There are bridle paths and a swimming pool but no neon-lit amusement places.

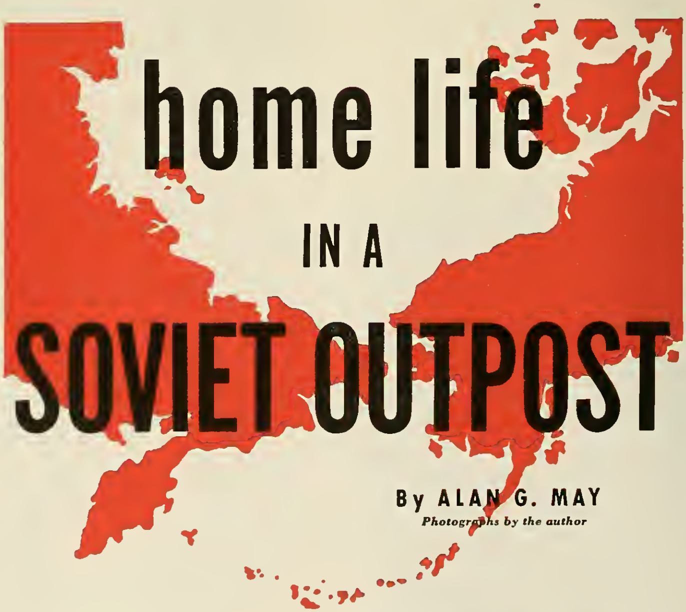
The Pennsylvania Department of Forests and Waters has made Cook Forest an educational as well as a recreational area. On the Lookout Road, leading to the summit of Seneca Ridge, your car passes through beautiful second-growth hardwoods. Along this road is the Demonstration Area, where large signs describe the kind of forest you are passing through. One of the most interesting is the Clover Field, which was a hayfield before 1900. Now fine young hardwood trees have seeded themselves here, and you may see how much woodland may be reclaimed by nature if left alone for 50 years. At the end of the Lookout Road is Seneca Point, where huge rocks jut out high above the river and valley below. Here is the Observation Tower, where a fire warden keeps watch and where you may climb above the treetops for a view of the whole forest and surrounding countryside. It is to the credit of both the Park officials and the conscientious public that there has been no serious fire in Cook Forest since it was acquired by the Commonwealth in 1927.

▲ **Eastern White Pine**, nearly 200 feet tall, resembling the mast trees used by the British Royal Navy before the Revolutionary War

▼ **Fungus-fruiting** bodies growing on a dead hemlock snag

One of the most interesting walks in the Park is along the Nature Trail. Many well-placed signs identify the trees and other plant life; sighting devices point out the nest of a crow and the holes made in a dead tree by the pileated woodpecker. Deer crossings, a porcupine den, claw marks on the trunk of a dead tree, a wild beehive, and many other interesting things are labeled for the visitor. Here, as you study nature, the hum of insect life, the small animal sounds, and the calls of the birds blend with the rustling trees to contribute to the murmur of the forest.

The same sun sets at almost the same moment on the blast furnaces of Pittsburgh as it does on the crowns of Cook Forest's tall pines. Modern industrial cities and densely populated areas encircle the Park. Yet here, watching the red glow fade to darkness in the complex pattern of foliage above, the roar of modern civilization is unheard and can fade momentarily out of our memories. This is the setting for a man in buckskin. This shadowy figure of our imagination carries a gun; he is seeking food for himself and his family from the abundance of the forest life. He pauses momentarily, his attention caught by a great tree. Perhaps he sees in its sturdy trunk a house to replace his rude cabin, a barn to house the animals he will someday have, fences to guard his crops against marauders, and a roaring fire for warmth and a good life. He sees these things in a flash of hope and then moves on.



home life IN A SOVIET OUTPOST

By ALAN G. MAY

Photographs by the author

★ Delaying tactics seemed on the verge of frustrating this American scientific expedition, but dramatic, zero-hour permission to land on the Komandorskie Islands began a series of events few westerners today can hope to experience

MANY thousands of years ago, at the close of the last great Ice Age, peoples from Asia migrated to America by way of Bering Straits. Until recent times, however, there was some question as to whether or not the Aleutian Islands were used as "stepping stones" for additional migrations. Anthropologists maintain that the Aleutian chain was occupied from the Alaskan Peninsula, subsequent migrations having pushed farther and farther out, until the people eventually reached the westernmost island of Attu.

Beyond Attu, 190 miles to the west, lie the Commander or Komandorskie Islands. Geographically they are a part of the Aleutian chain, although they belong to the Union of Soviet Socialist Republics. Only 95 miles from the Kamchatka Peninsula, the islands come under the jurisdiction of the Autonomous Republic of Kamchatka.

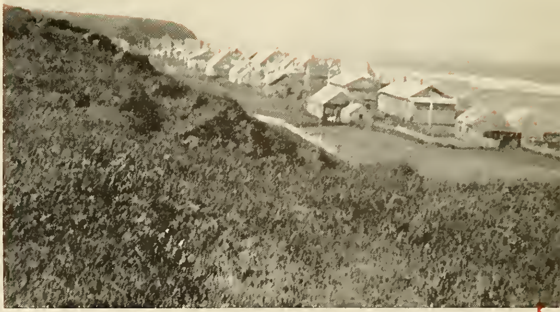
Evidence found by expeditions working outward along the Aleutians sustained the theory that the islands had been occupied from the Alaskan mainland westward. But had there been any eastward migrations? The most obvious place to search for evidence of such a movement would be the Komandorskie group. As archaeolgical information concerning these islands was practically nonexistent, it would be necessary to make investigations on this Soviet territory before the question could be answered.

Unfortunately, the Soviet authorities did not appear to look on such a project with much favor. After considerable time, our Administration in Washington was able to obtain permission from the Government of the U.S.S.R. for the late Dr. Aleš Hrdlička of the Smithsonian Institution to take a party to the Komandorskie Islands for archaeological investigations. Arrangements for the visit in the summer of 1937 were supposedly completed before the expedition left the United States. Again, in 1938, Dr. Hrdlička applied for and received permission to take a group to the islands. The writer was a member of the expeditions on both occasions.

For reasons known only to the Soviets, delaying tactics, such as employed so often at the United Nations, were used by them on this occasion—*after* we had commenced the journey. Word received by our State Department from the Foreign Office in Moscow stated that the People's Commissariat for Foreign Affairs claimed that "a new situation had developed in the Komandorskie Islands"; consequently, permission to land could be communicated to the island authorities only after a delay of several days. This may be the reason why, when we arrived off the village of Nikolskoye on Bering Island, none of the officials had any knowledge of our coming.

The Komandorskie group is made up of two islands, Bering and Meydni (Copper), together with two or three small rocky islets. Bering is about 45 miles in length and 20 miles across at the northern or widest part. Meydni, 25 miles east of Bering, is long and narrow—30 miles in length but only 4 miles across at its widest point. The islands are mountainous with several peaks of between 2000 and 2200 feet. Near the village of Nikolskoye there is a large area of rolling country with many sand dunes. Like the Aleutians, the islands are desolate, dreary, and treeless. Earthquakes and severe storms are frequent. The climate, while harsh, is not severe. Waters

▲ THE SOVIET OFFICIAL Antipov *(left)*, second in command and Commissar of Police, and Dimitri Paliakov *(center)*, leading biologist of the islands, accompany the late Dr. Aleš Hrdlička on a tour. The expedition visitors had the freedom of the islands, with the exception of the barracks and the radio and meteorological buildings



▲ THE VILLAGE of Nikolskoye, with a population of 210. The people raise some vegetables, cattle, hogs, and blue foxes. There is only one store, which was reasonably well stocked with general merchandise

▲ LIEUTENANT LAZEROF (white hat), chief Soviet authority in the islands, supervises the removal of fish from a fish trap. A gift of 50 large salmon was presented to the expedition party, who could repay only with the traditional American cigarettes

▲ MR. AND MRS. ANTIPOV, who opened their home to American guests. In the background is Lieutenant Lazerof

around the group do not freeze in the winter, although at times the ice piles up on the beaches when brought in by prevailing winds. During the winter there are heavy snowfalls, and some of the snow remains sometimes until the middle of August, which is the warmest month of the year.

Free copper is found on Meydni, as well as copper in combination with silver. Small deposits of iron and coal are found on Bering, together with dyeing clays of varying qualities.

Bering Island was first discovered by Captain Vitus Bering and his crew, when their ship, the "St. Peter," was thrown upon the shore during a violent storm, at a place now known as Komandor Bay. Bering, a Dane, had been commissioned by Peter the Great of Russia to discover whether or not Asia was connected with North America and also to establish contact with America. It was on the return journey of his second expedition, after Bering had sailed as far east as Kayak Island near Prince William Sound, that the "St. Peter" was wrecked on Bering Island on November 6, 1741.

The castaways, weak and ill from scurvy, were plagued almost beyond endurance by the innumer-

▲ Once the Russian Orthodox Church, this building was stripped of all religious insignia and converted into a Social Hall. To the right is the monument to Vitus Bering, discoverer of Bering Island

▲ Nikolskoye villagers enjoy a rare interlude of sunshine. Clouded skies had concealed the sun for the past five months

able foxes. These animals had absolutely no fear of man. William Steller, the German naturalist attached to Bering's party, reported he killed over 70 foxes with an ax in one day—using the pelts to cover the roof of his makeshift hut. At the time, the island was uninhabited; the foxes had probably arrived on drift ice from Kamchatka. Thirty-two days after being wrecked, Vitus Bering died on the island. From the remains of the "St. Peter," the survivors, only 45 out of a crew of 77 men, built a small boat and set sail for Avatcha Bay on the mainland. On arrival, nine months after they were wrecked, they found they had been given up for lost. Their personal possessions had been appropriated by the inhabitants.

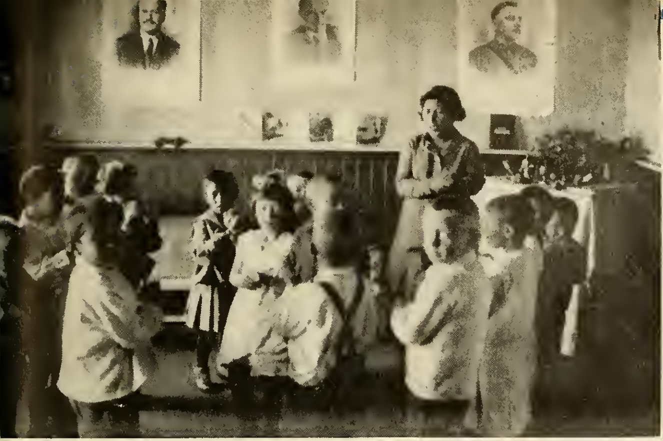
As guests aboard the United States Coast Guard Cutter "Tallapoosa," under the command of Captain N. G. Ricketts, we arrived off the village of Nikolskoye on Bering Island in mid-July, 1937, only to learn that we were not to be permitted to land. This was a bitter disappointment, for some of our party had traveled over 6000 miles to investigate these archaeologically unknown islands. Now it appeared we would have to return without even having set foot ashore.

Six Russians came aboard the "Tallapoosa" wearing a navy-type uniform; two of them were officers. The senior officer, we learned later, was a Lieutenant Lazerof of the Border Patrol. He was a small, nonsmiling, intelligent-looking man. The other officer, named Antipov, was the second-in-command, and he also held the office of Commissar of Police. He was a friendly sort of person but had little to say in the presence of the Lieutenant. The two officers and the patrolmen were well turned out, especially considering that their post was so far from civilization.

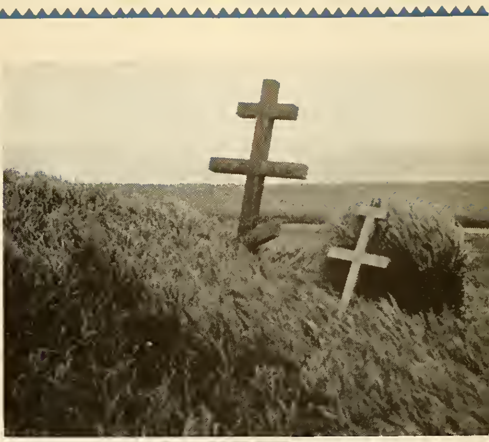
Because of the language difficulty, the conference that was held developed into a lengthy discussion with, apparently, some misunderstanding on both sides. Dr. Hrdlička's Russian was a bit rusty, and he claimed the Russians spoke a dialect with which he was not too familiar. As the Russians claimed to understand some of the Aleutian language, the Doctor sent for Makari, an Aleut guide from Atka who was with us. It was hoped that Makari would be able to assist in interpretation. However, on seeing the Russian Lieutenant and his aide, Makari became so frightened he could hardly speak. All the Aleuts on the Komandorskies are descendants of those forcibly taken there by the Russians in the early 1880's. Some time later, when Makari had an opportunity to go ashore, he refused to do so, thinking he would be held there.

Lieutenant Lazerof was arrogant, truculent, and domineering. We had arrived, said he in effect, without permission and were therefore under his jurisdiction. He wanted to inspect the ship. He wanted to examine the arms in the armory. He wanted all cameras placed in the radio room before he sealed the door. He wanted to check off everyone aboard from the ship's roll call. In fact, it seemed as if he went out of his way to do all he could to antagonize the personnel of the ship. The situation would have been amusing had not time been so important to us. Finally, it was arranged that Lazerof would radio to Petropavlovsk for instructions, and we hoped this message would be relayed to Moscow. In the meantime, Captain Ricketts agreed to move out beyond the three-mile limit to await the reply, provided it arrived within a reasonable time. Unfortunately, through circumstances beyond our control, we could wait only two days. Permission would have to arrive before 7 P.M. on the second day or we would have to commence the return journey.

For two days we waited on a rolling sea; heavy rains, fogs, storms, and an occasional brief glimpse of



▲ KINDERGARTEN CLASS in session. The children, both Russian and Aleut, appeared in excellent health and were clean and well dressed—habits that are apparently encouraged in the educational program



▲ VITUS BERING'S GRAVE, on a lonely hill overlooking Komandor Bay, is marked with crosses erected long ago. On the beach below lies part of the keel of Bering's ship, the "St. Peter"

the sun helped break the monotony. When no word was received from the Soviet officials by 7 P.M., orders were given to weigh anchor. It was most discouraging. With the anchor half raised, there came a sudden shout: "Boat on the port bow, Sir!" Dramatically, at the very last moment, out of the fog and the rain, there came a small Russian boat, pitching and tossing wildly in the tempestuous seas.

Lazerof and Antipov came aboard to tell us that permission for our landing had been granted by the authorities. Apologies and regrets were expressed for the delay. They had been searching for the cutter for over five hours in the fog and rain. Honoring the arrival of the American ship, an official reception was to be given that evening in the village. Captain Ricketts, Dr. Hrdlička, and I were invited as the visiting American representatives.

Lazerof insisted that we go ashore in their small boat while the "Tallapoosa" followed under his guidance to a safe anchorage. This insistence was doubtless intended as a gesture of friendliness, but it proved unfortunate for us. The Russians manipulated their boat from a tiny cockpit in the stern, while the three of us had to cling to a small mast on a deck with no railings. The boat bucked and tossed, seas swept over it, and we were drenched. About 30 feet from shore, an anchor was dropped. Slowly backing away shoreward, the boat reached shallow water and the rudder was taken out. Proceeding a bit farther to shallower water, the propellor was raised on a universal joint. In this manner, the boat came to within eight or ten feet of the beach. A plank was thrown down, and we were able to walk ashore without stepping in the water; nevertheless, we were all cold and wet.

At the landing place—a shingle beach about a mile from the village—a lone blue fox crept up and sniffed at us. No one was in sight, but at a shout from Lazerof, there suddenly appeared from nowhere a group of children accompanied by a few older people. They gazed soberly at us from a distance, not replying to our greetings.

Following the graveled road toward the village, we came to the experimental fox farm and were invited in to see the animals. As it was almost dark by this time, little could be seen of the foxes. The buildings appeared to be well kept, neat, and clean, although there was a somewhat unpleasant odor.

Various buildings were pointed out to us as we passed through the village—the school, the barracks, and the social hall, which had previously been the church. All of the buildings were numbered and marked with the year of construction. The earliest date seen was 1880.

Lazerof led us into one of the larger houses, and we were introduced to several Russians and three Aleuts. Our host, we understood, was in charge of the radio and meteorological station. He had lived in Iceland for two years and at some time had picked up a few words of English. Now he was stationed here for three years while his wife and child were in Moscow. Dimitri Paliakov, the leading biologist of the islands, was a courteous gentleman who wanted to talk to us but was baffled by the language difficulty. Only one woman was present — a teacher of industrial work and animal husbandry. One of the Aleuts was the chief, while the others must have held some official position. Our conversation, if it could be called that, was long, arduous, and accompanied by much gesticulation. But with the help of the Doctor, we were sometimes able to make ourselves understood.

Raw fish was served after we had all been seated at a large table. This fish, we were proudly informed, was the famous Kamchatka herring. However, it was not very appetizing. Conversation lagged; the affair seemed stiff and formal. After providing everyone with a half-filled tumbler of vodka, one Russian rose and made a toast. The vodka, with which I was not familiar, tasted something like raw alcohol; so after taking a sip, I placed the remainder on the table. Lazerof, who was sitting next to me, dug me viciously in the ribs with his elbow, indicating with gestures that that was no way to drink a toast—it was a case of "bottoms up."

Quantities of food were brought in and passed around. A young reindeer and a suckling pig had been killed for the occasion, which was evidently regarded as a gala event. More toasts were given, but Dr. Hrdlička placed his hand over his glass when Antipov was about to refill it. Apparently the Doctor's refusal was accepted on account of his age. For Captain Ricketts and me it was a different matter, for the Russians would not accept a refusal from us. The Captain, a nondrinker, was on a spot, for to refuse to drink the toasts would have been an insult—or so we were given to understand. Toasts were given to America, to the U.S.S.R., to better relations between the two countries, to the Russian flyers, who that week had flown overhead on their way to America, to the Five Year Plan and others, in a seemingly endless series. Rising from the table, swaying slightly from side to side, one Russian patiently waited for everyone's attention. Holding his glass high, he said solemnly in English, "America, Goodby." Doubtless, these were the only English words he knew, so we drank to that, too, not wishing to tell him his English was a bit mixed.

In order to maintain the necessary prestige as the visiting American representatives, the Captain and I had to down drink for drink with the Russians. In all due modesty, I may say that we came through this ordeal better than did some of our hosts. One of them suddenly departed from the table and did not show up again until late afternoon of the following day. Another gradually slumped under the table. Toward the end of the meal, the last bottle of vodka on the island was ceremoniously placed on the table. Evidently containers were scarce, for the liquor arrived in a sulphuric acid bottle. Had it been acid, it is doubtful if anyone would have noticed the difference by then. The meal finished with piping hot tea into which was poured a teaspoonful of an unknown liquid from a perfume bottle, while American, Japanese, and Russian records were played on an old-type horn phonograph. It seemed odd to hear "Oh! Susanna" played on a Japanese record on a Russian island. Perhaps it was not so very strange that the Captain and I, walking back to the boat arm in arm for mutual assistance, found the road so much rougher than it had been a few hours earlier!

Left high and dry by the receding tide, the Russian boat lay on its side many feet from the water. Our hosts offered to put us up for the night. Returning to the village, Lieutenant Lazerof invited Captain Ricketts to stay at his house for the night, while the Commissar invited the Doctor and me to his home.

Mrs. Antipov was not in the least perturbed at being awakened in the early morning hours. She cheerfully found blankets for us while her husband was setting up two folding cots. This home, like others here, was spotlessly clean; it was evident that the Antipovs were fond of flowers, for geraniums, nasturtiums, and fuchsias were growing in window boxes.

Proud of his home, Antipov showed us some of his possessions in which he thought we might be interested. He showed us his small library and the local newspaper, *Aleutskaya Pravda,* which was published every six days. In a newspaper published in Petropavlovsk, he pointed out an article about the Aleutian Islands, written by the well-known botanist Dr. Isobel Hutchison, whom we had known at Dutch Harbor in 1936. The article had been taken from the London *Times.* From another room Antipov brought out his rifle and modern gas mask for our inspection. In order to entertain us further, he showed us some samples of free copper from Meydni, as well as many interesting photographs. Some of the latter showed sea otters, which were being raised in captivity at Gladskuvskaya Stanovische on Meydni Island. At that time, this was the only place in the world where these attractive animals were being bred for experimental purposes. Other photographs showed fur seals in large pens, for here the Soviets are raising seals in captivity for the first time in history.

The governmental authority of the islands was vested in Lieutenant Lazerof. The office of Director was held by a man named Ayleesh. As I understood it, Ayleesh was assistant to Lazerof, although Antipov was his senior in rank. Three Aleuts were members of the governing Council of seven persons. Protection and defense of the islands naturally came under the supervision of the Lieutenant and his "army" of about a dozen men.

Cabbages, potatoes, onions, parsley, and beets were seen growing in fenced lots the following day. Reindeer had been imported and appeared to thrive on the lush grasses. Fine-looking cattle were raised, as well as hogs and blue foxes. In many cases, foxes lived under the houses and were comparatively tame. We saw children playing with fox pups and fox pups playing with kittens. One fox was seen dragging a small rug from one of the houses. Hogs and foxes were unconfined and roamed the village at will, with the foxes acting as scavengers.

Possibly regulations prevented us from being invited into the barracks and radio and meteorological buildings, for these were the only buildings we were not free to enter. The radio station is situated on the hill behind the village. Climbing the hill with an idea of taking a photograph of the village from above, I was chased by one of the troopers, who indicated emphatically that I was to return to the village. Obviously visitors were not wanted near this building, for the trooper stayed at my heels till I rejoined the others down below.

A nurse was in charge of a small hospital and fortunately for us, she was able to speak some German. Compared to our city standards, the hospital would be considered very crude, but it appeared satisfactory in such an outpost of civilization.

We entered the school and were shown into the kindergarten. The children, both Russian and Aleut, appeared in excellent health and were clean and well dressed. Without doubt, we were expected. "Good morning! Good health to you!" they chanted in unison as we entered—in Russian, of course. Lazerof was very proud of the kindergarten and insisted I take some photographs. In another room, two women in white uniforms cared for tiny tots and infants, whose parents were out at work. There was an adequate kitchen where, we were told, hot meals were prepared for the youngsters. In the cloakroom were several washbasins with individual towels hung on pegs; the children's coats hung on the opposite wall. Cleanliness and health appeared to stand out prominently in the educational program. Without doubt, such instruction has proved beneficial, for during the two visits to the islands, we saw only one house that was not neat and clean.

◂ Head man at Glinka Gavan. The cap denotes his authority

▾ A Red Flag flies over the headquarters and home of Director Zykov at Preobrazhenskoe, the only village on Meydni Island. Here radio news is copied in longhand, put into pamphlet form, and passed from family to family

▾ Residents of Preobrazhenskoe dressed in their best clothes on the occasion of the expedition's visit

We were unable to purchase anything at the one and only store, as only Russian money was acceptable. The store was reasonably well stocked with general merchandise. Our hosts presented each of us with a chocolate bar from the stock on hand, and this compared favorably with American chocolate.

Because of the abolition of religion, the old Russian Orthodox Church, with all religious insignia removed, was now used as a social hall. Occasionally movies, dances, and amateur theatricals were held in this building. Reading material—newspapers, magazines, instructional and propaganda pamphlets, together with a fair-sized library (with books by such well-known authors as Tolstoy and Dostoyevsky being most noticeable)—occupied one room of the social hall.

Close to the hall was a monument of Vitus Bering. Embossed lettering on a metal plate paid homage to Bering. The anchor from the "St. Peter" lay to one side, and the whole was encircled by the anchor chain from Bering's ship and topped by a cross.

Near the center of the village, hanging from a wooden frame, was a beautiful bronze bell with decorative design in relief. It came from the church and is now used to call the people together for all important announcements. A very similar bell was in the church at Attu before the Japanese invasion.

Archaeological investigations were confined to the immediate area of the village, owing to lack of time for further exploration. No indications of an early settlement were observed, and no archaeological material was found. The locality of the village was a propitious place for an ancient site, for there was a stream for fresh water, a good beach for skin boats, and hills at the rear where lookouts could have been posted. Considerable erosion near the mouth of the stream could possibly have obliterated any old site that may have been there. A small area of the beach was littered with reindeer antlers and the bleached bones of seals, whales, sea lions, sea otters, reindeer, foxes, cattle, and hogs. Probably this place was the dumping ground after butchering.

When we arrived in early July the following year on the U.S.C.G. Cutter "Shoshone," under the command of Captain J. Trebes, we were greeted with great friendliness. Once again a reception party was held, this time in the home of Commissar Antipov. A vivacious redheaded young lady, Mrs. Chernofsky, wife of one of the schoolteachers, assisted in serving the meal. Again many toasts were given —too many but not as many as the previous year.

Before leaving in 1937, the ship's officers had given Antipov some Wenatchee apples. Now he very proudly called our attention to a small apple tree growing in a jar by his window. He had grown this small tree from the seed of the apples given him. It was the first apple tree ever grown on the Komandorskie Islands.

During the meal a Russian entered and, after obtaining permission from Lazerof, made a formal challenge to the men of the "Shoshone" to a handball game that afternoon. Naturally Captain Trebes accepted the challenge. The game was played in a friendly spirit with great excitement on the part of the onlooking inhabitants. The Russians won, but as one Coast Guardsman said afterward, "Well, no wonder they won. They played by one set of rules and we played by another!"

We had arrived on one of those infrequent sunny days, and we noticed that the school children had moved their desks outdoors into the sun. Later in the day while the sun was still shining, we saw one

▲ ALAN G. MAY and an Aleut at Staraya Gavan. Transportation throughout the islands, other than by water, is accomplished by dog team and sled even in summer over the grass

▼ A BORDER PATROL MAN poses with a young schoolteacher from Moscow

▲ SOVIET WHALING SHIPS in Preobrazhenskoe Bay. They had no whales alongside, although many had been seen offshore from Meydni of the teachers taking a group of children for a walk. This was the first time they had seen the sun for five months, and they were taking full advantage of it.

Director Ayleesh invited some of us to a dinner at his home that evening. Two suckling pigs were served, and it was during this meal that the following information was gathered:

The Soviet Government pays a pension to all nationals unable to work, regardless of age. A town started in 1935 on the Sea of Okhotsk had, by 1938, reached a population of 40,000 persons; in the vicinity of this city, over 400 miles of roads had been built. The Second Five Year Plan had been completed seven months ahead of schedule, and the Third Five Year Plan was then in operation. From a population of 210 people in Nikolskoye, 2700 rubles had been donated to the Armament Cause. Forty-three vessels reached Vladivostok by way of the Northeast Passage in 1936, although the previous year only sixteen were able to get through. This District was the first, in what the Soviets term the Far North, in which the whole population became literate.

Just how much of this information can be believed is, of course, questionable.

Later in the evening we were invited to a dance at the social hall. A phonograph was being used for music, but later one of the Russians played an accordion for the dancing. The dancing of the Aleuts was indeed both active and strenuous, the men wiping the perspiration from their faces on their sleeves, while the women used the collars of their dresses. In charge of the dance was a master of ceremonies, whose official capacity was indicated by a red band on his coat sleeve. Carefully he tried to explain to the Doctor just what was going on, so that the Doctor could, in turn, inform the visitors. The star turn of the evening was a Caucasian-type dance by Mr. and Mrs. Chernofsky, who could not have done better had they been professionals. They performed with great zest and abandon, apparently enjoying the dance even more than the spectators.

This time permission had been given for us to travel about the islands so that archaeological investigations might be made in likely places. Leaving Nikolskoye, we stopped first at Syevexnoe, where the fur seal rookery is directed by a young biologist. Conservation methods similar to those in use on the Pribilof Islands are in force here. Only the three-year-old males are killed for pelts. We were informed that this herd had been increased from between 2000 and 3000 up to approximately 50,000 animals.

Rounding the northern end of the island, we called at Sarana, a small settlement consisting of about a dozen Aleuts. One large storage building was full of dried fish tied in bales. Near by were several acres of fish drying on racks. In the river was a fish trap full of squirming fish. This trap was of exactly the same type as those built by the Aleuts of our own islands. It was suggested to Lazerof, who had accompanied us, that a few fish would be most acceptable to the ship's crew. At a word from the Lieutenant, some Aleuts ran down to the trap and returned with about 50 fine large salmon. We were only able to repay this generosity in an extremely small way—by giving the inhabitants cigarettes. It was noticeable that none of the Aleuts accepted the cigarettes without first looking for permission from Lazerof. He made no objections. Although the weather was not cold, almost all the Aleuts were wearing quilted jackets.

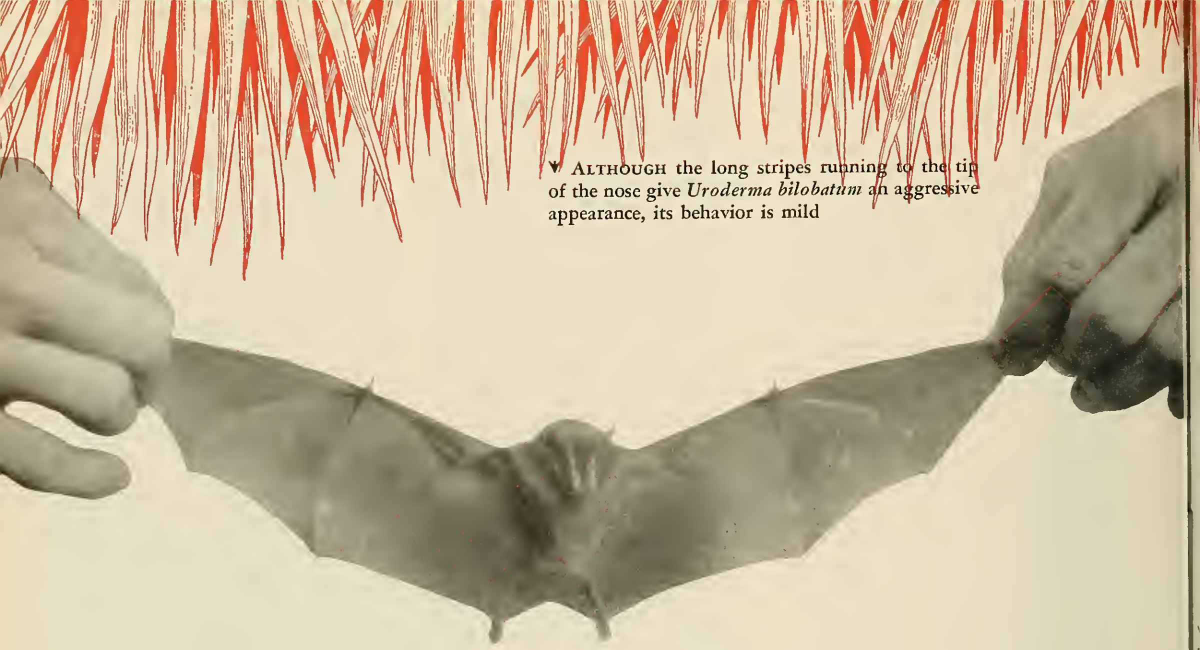
Transportation throughout the islands, other than by water, is accomplished by dog team and sled both in winter and summer. A special strongly constructed sled is used with efficiency over the tundra in the summer months. This sled is only about five feet long, with runners twice as wide as those used on snow. While excavating at Sarana, an Aleut arrived on one of these sleds with much yipping and shouting at his eleven-dog team. The sled dogs had been imported from Siberia, and many of them were quite vicious.

From Polovina Bay, where we made our next landing, we walked overland to Komandor Bay, the site of the wreck of the "St. Peter." Along the way, on a sandy beach, we came across hundreds of green Japanese glass balls used as fishnet floats. Above Komandor Bay, on a small knoll, we found Bering's grave. Originally it had been marked by a small mound of earth. Many years after Bering's death, the Russians had erected a small wooden cross at his grave. In time, this disintegrated at the base and fell. Then, in 1914, the crew of a Russian naval ship visited the bay and set up a larger wooden cross. This cross still stands on that lonely hill. On the beach we came across all that was left of the wrecked "St. Peter"—a large squared piece of lumber that had evidently been part of the keel. Big hand-forged square nails were extracted as souvenirs. Returning to the ship in the motor launch, we hit and slid over, without damage, an unseen reef—in all probability the very same reef on which the "St. Peter" came to grief in 1741.

Leaving Bering, we sailed over to Meydni, stopping at Shushkinskaya Buchta and Korabelni. Both of these settlements consisted of two or three houses and one or two families. The homes in these isolated places were spotlessly clean. Floors were well scrubbed, the brick stoves had recently been whitewashed, and in one home the copper tea kettle was bright and shining. No samovars were seen in the outlying settlements, although they were in use in the two villages. It is certain that this cleanliness and neat housekeeping was not done for our benefit, for these Aleuts were the most astonished people in the world when we arrived. It is more than likely that they had never seen such a beautiful vessel as the fine white Coast Guard Cutter anchored offshore.

We were well fooled by one Aleut at Glinka Gavan, who claimed to know where there were some old

Continued on page 285



▼ Although the long stripes running to the tip of the nose give *Uroderma bilobatum* an aggressive appearance, its behavior is mild

Bungalow-Building Bats

A series of snips with the teeth, and this winged engineer of the tropics converts a fan-shaped palm frond into a home that is snug and waterproof

By Kenneth W. Vinton

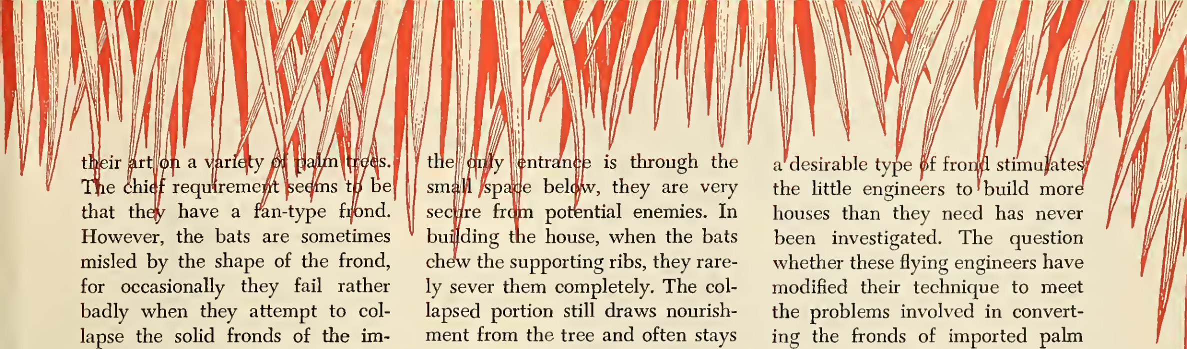
Photographs by the author

BATS are strange creatures at best, misunderstood by many people who still think the major sport of these flying mammals is to snarl themselves in one's hair. Bats are found in great variety and in many parts of the world, but some of the strangest members of this odd clan are to be seen in Panama. They vary from ugly broad-chested jungle bats, with a wingspread of nearly two feet and faces like gorillas, to fragile little mothlike creatures that scarcely look like a bat. There are fruit-eating bats, insect-eating bats, and the vampires of ill repute, which feed solely on fresh blood. Some have faces like bulldogs, others look like mice, while the most diabolical-appearing ones have the tip of the nose decorated with an erect spearlike growth that resembles a leaf.

In spite of the variety of forms, habits, and characteristics of the Panama bats, all of them seem to agree that the most desirable place to live is in the dark. In settled areas, the dark corners in deserted buildings, attics, and old belfries will usually yield their quota of these nocturnal creatures, while natural caves are always a standard habitat for countless other thousands. Those living in the jungle find shelter in hollow logs and hollow trees; and even a temporary house like an old empty bees' nest is never overlooked. Many hide in the deep shadows of matted vines; others commonly use the drooping fronds and broad leaves as shelter.

However, in this diverse nocturnal clan there is one stripe-nosed bat, *Uroderma bilobatum,* that is not content to take "pot luck," but like a good engineer, it builds its own bungalow of palm fronds. Another bat in Panama, *Artibens watsoni,* has been reported to have similar habits. The accompanying photographs show the simple but effective technique that *U. bilobatum* uses in converting a fan-type palm frond into a snug house. As though guided by the calculating eye of a mathematician, the bat cuts the midribs of a leaflet in a circular course around the base of the fan. The frond then collapses to make a cylindrical enclosure of drooping leaflets.

These little architects practice

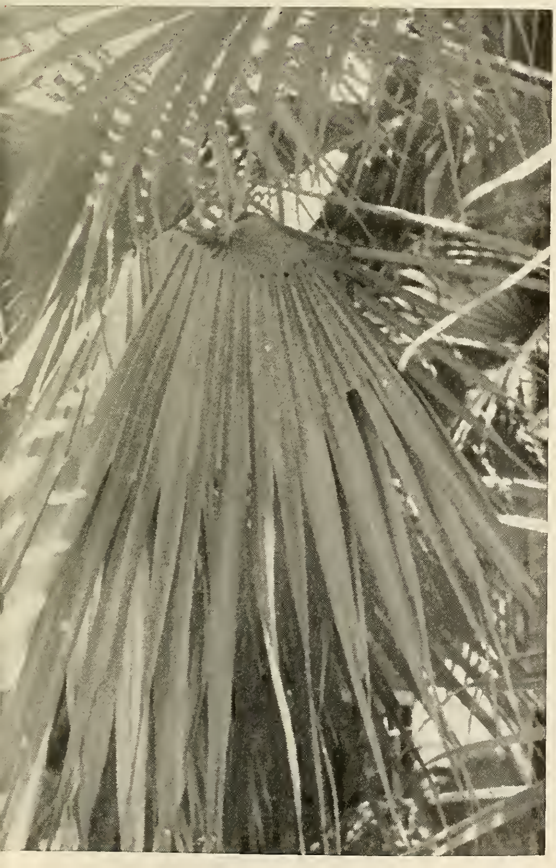


their art on a variety of palm trees. The chief requirement seems to be that they have a fan-type frond. However, the bats are sometimes misled by the shape of the frond, for occasionally they fail rather badly when they attempt to collapse the solid fronds of the imported Chinese fan palms.

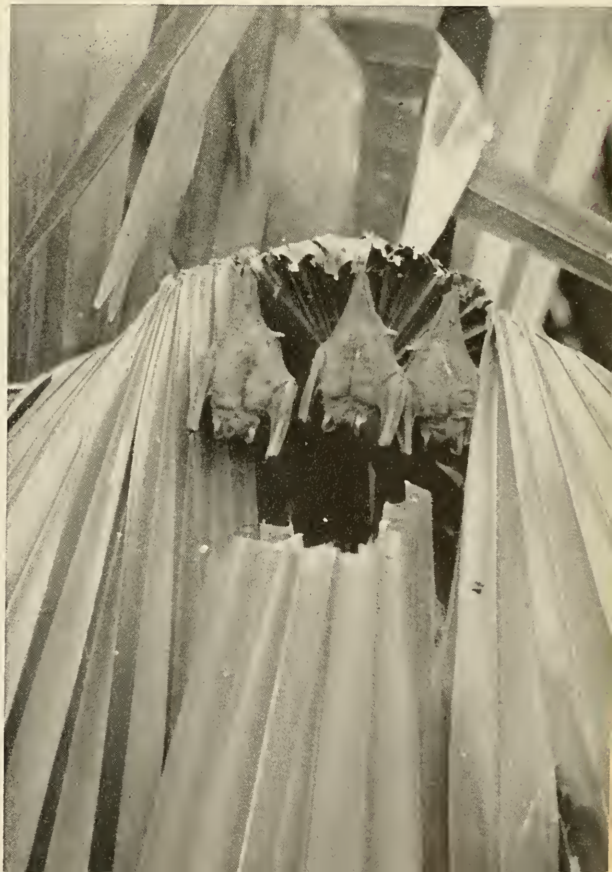
A little outdoor observation in the cities of Balboa, Ancon, or Panama City will reward the seeker with an interesting view of the drooping bat-built bungalows. These palm frond houses are dark inside and waterproof; and since the only entrance is through the small space below, they are very secure from potential enemies. In building the house, when the bats chew the supporting ribs, they rarely sever them completely. The collapsed portion still draws nourishment from the tree and often stays green from six to eight months.

How these little bats happened to start building houses of palm fronds is a mystery. The urge that starts them working on a new house is unknown. Many fronds seem to be collapsed, then left unused. The possibility that a palm tree with a desirable type of frond stimulates the little engineers to build more houses than they need has never been investigated. The question whether these flying engineers have modified their technique to meet the problems involved in converting the fronds of imported palm trees into houses remains unanswered. In short, we know very little about the reasons why this bat builds its house as it does. But basing our decision on how he does the job, it is surely not an overstatement to call him the engineer of the bat world.

▼ THE BAT cuts the midribs of a large frond, and the leaflets fall into a vertical position. Note the circular line of the cutting, which gives the collapsed fan a cylindrical shape



▼ THE BATS are so timid that the author was forced to resort to trickery to show them hanging in their home. They were captured in a butterfly net, etherized until they were too groggy to fly, and then hung in the opening of their cutaway house for a quick photograph



OPERATION
Snailfolk

By
R. Tucker Abbott
Division of Mollusks,
United States National Museum

In one of man's strangest experiments, a slow-motion

David and Goliath are at this moment locked in battle on a tiny Pacific island.

The outcome will influence the future of agriculture in certain parts of the world

GOLIATH, the giant African snail, is the six-inch-long, plant-eating dilemma of agriculturists in the Pacific Islands. In little less than 100 years, this hungry pest has spread from Africa eastward across the tropical areas of Asia and the East Indies and northward to our Trust Territory and the Hawaiian Islands.* Anxious agricultural quarantine officers in the Americas have intercepted Goliath on incoming ships at least seven times in the last three years. An act is now before Congress in which a fine of $500 and a one-year jail sentence await any person bringing the giant snail into the United States.

Because of his ability to establish himself quickly in new areas and the speed with which he reproduces, Goliath has caused man to employ every means at hand to rid the islands of this molluscan monster. Poison baits, hand-picking, protective ditches, live steam, flame throwers, and cyanide gas have all been tried with varying degrees of success. Although commercially grown crops are now for the most part considered sufficiently protected, Goliath continues to flourish in the hills and often raids small flower and vegetable plots. His continued presence in the islands presents a constant threat to areas not yet invaded.

At last comes hope from an unusual quarter—from Goliath's homeland and from among his former jungle associates. David, the African *Gonaxis*, is a small, thimble-sized snail with a voracious appetite for other snails. At this moment, Goliath and David are locked in battle on a tiny, remote island in the western Pacific in one of the most unusual biological control experiments ever attempted. The recent introduction of David to the experimental island of Agiguan (or Aguijan) in the Marianas Islands is one of several projects that have been undertaken by the Pacific Science Board of the National Research Council to reduce the effectiveness of destructive Goliath.†

"Operation Snailfolk" began in 1949 when Dr. Francis X. Williams was sent to British East Africa to search for a natural enemy of the giant African snail (*Achatina fulica* Bowdich). An intensive study was made along the coasts of Kenya Colony, Tanganyika Territory, and Zanzibar. Dr. Williams' search finally ended in a small bit of jungle south of Mombasa, Kenya Colony, where he discovered the presence of David, more familiarly known to scientists as *Gonaxis kibweziensis* (E. A. Smith). In Dr. Williams' opinion, David had all the qualifications for slaying Goliath – a healthy appetite, a weakness for giant African snail meat, and, unlike other predators of *Achatina*, such as the mongoose, baboons, and rats, a meek and retiring disposition.

It was a year later that I was called on to follow in Williams' footsteps and collect enough live Davids for the biological control experiment on Agiguan. My flight to Africa and thence around the world via the Marianas Islands was to be another chapter in the unusual story of "Operation Snailfolk." On a chilly

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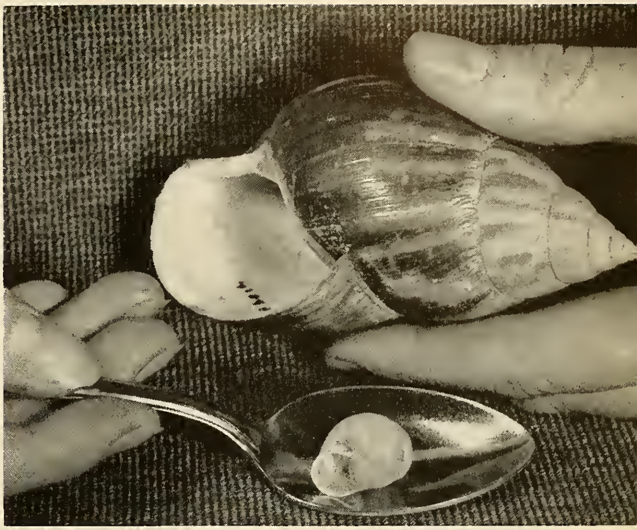
* See Dr. Abbott's articles "March of the Giant African Snail," NATURAL HISTORY, February, 1949, and "Snail Invaders," NATURAL HISTORY, February, 1950. —ED.

† These studies were aided by a contract between the Office of Naval Research, Department of the Navy, and the National Academy of Sciences.

➤ **DAVID AND GOLIATH.** David's healthy appetite and his weakness for giant African snail meat may profoundly affect agricultural output

AMNH photo



▼ **THE ODYSSEY** to control a certain snail on the opposite side of the world began in a museum office in Washington, D. C. The big, crop-eating *Achatina* had spread at an alarming rate; but reports from Africa hinted that the little *Gonaxis* might be more than a match for it

Courtesy of James Nevin Miller

April morning I passed by the cherry blossoms on the way to the Washington airport, and in less than two dozen hours I was watching at night through the plane windows the flashing of lightning of the great storms that guard the upper reaches of the Nile. At dawn, the blue-gray shores of Lake Victoria could be seen on the hazy horizon, and by noon the plane had settled her wheels on the modern airport at Nairobi, capital of Kenya Colony. I could not help but feel, despite the marvel of modern air transportation, that this had been a shallow experience in comparison to the months of toil endured by men like Livingstone and Stanley to gain half this distance.

By May 1, I was settled in a small *banda* (thatch-roofed hut) at Diani Beach, which borders the Indian Ocean some 20 miles south of the port of Mombasa. "Enlightened and modern" Africa soon meant hot days of endless rain on the coast, struggles on washed-out roads, dreary work alone at night by the light of a kerosene lamp, and daily tramps into the thick bush in search of snails. One of the operational necessities of this phase of the project was to strike quickly—to collect as many Davids as possible in the shortest time. Intelligence reports from Williams and other snail scientists indicated that successful hunting could only be done during the few short, rainy weeks of spring. I was pioneering in capturing large quantities of this relatively uncommon species. In addition, the problems of shipping sensitive live snails were yet to be met.

The rainy season was now two weeks old, and the forest behind my *banda* had already been transformed from its brown, dry sleep of months of drought to a refreshing, ever-expanding world of living green. There was little difficulty in finding specimens of the giant snail.

On wet days like these, every living Goliath was lumbering about in full view, foraging for food. In certain areas, empty Goliath shells were scattered about the jungle floor like so many bleached bones—mute evidence of the effectiveness of his natural enemies and the mysterious hazards of life in the African wilds. For the better half of the first day, I searched in vain among the clumps of grass, under fallen leaves, and in the soft wet earth for elusive David. Occasionally I would find his empty shell. At long last I discovered my first living specimen nestled against a half-buried Goliath about two inches under the soil. I realized then that David was most apt to be found in the vicinity of a Goliath who was either in a state of quiescence or in the act of laying eggs. But even armed with this knowledge, I was unable to find more than a dozen living specimens on the first day.

That evening in my *banda*, by the light of a kerosene lamp, I examined my tiny captives. David carries about with him one of the strangest of snail shells. Unlike most shelled land snails of the woods and gardens, whose whorls are evenly coiled with a gentle, geometric increase in size, David has grown on a kilter. He has the appearance of having been squashed obliquely to one side. The body, foot, and delicate tentacles are colored a beautiful yellow-orange. When withdrawn into the shell, they give the translucent, amber-colored whorls a delicate pinkish tint.

When David is hungry, he can sense the presence of a near-by Goliath by means of his olfactory organs, located in the tentacles. David has no special method of attack, no secret weapon. He simply glides or burrows toward the inviting odor and, upon reaching a wall of *Achatina* meat, begins to gnaw and scrape off bits of flesh. The lumbering Goliath rarely, if ever, attempts to escape. His only defense is to withdraw into his own shell and secrete a token blanket of mucus. The farther Goliath withdraws, the closer the attacker moves in, and because David is so small, he can follow into the aperture of the big shell and literally eat his victim alive.

▼ **One** of the thatch-roofed *bandas* at Diani Beach, Kenya Colony, where the author accidentally discovered the secret of putting his voracious snails to sleep for shipment to an islet in the Pacific

R. Tucker Abbott photo

I realized that I should be collecting far more than a dozen Davids a day. I needed over 1000 healthy specimens, and, if the mission stretched out over a period of a month, I had no assurance that the snails collected on the first few days would remain alive in captivity for any great length of time. Attempts to lure David by crushing giant snails and setting them out at night in little piles on the forest floor were unsuccessful. An ant collector would have proclaimed the experiment a roaring success.

R. Tucker Abbott photos

▲ David, the African *Gonaxis*

Then I put a bounty on David's head—a price that would assure the undivided attention of the local natives. For a week, a minimum of land-clearing and stone-hauling was done in the area, but the Davids began to turn up in encouraging numbers. In the late afternoon, the natives would line up outside the *banda* where the strange *Bwana* sat and paid ten Kenya cents (two cents U. S.) for each *doo-doo*. On the second evening, I ran out of small change as my collection of Davids reached the 300 mark. I began to issue I.O.U.'s and sent into Mombasa for a large sack of coins. Within 10 days I had an ample supply—2000 healthy specimens—so I allowed the price per snail to slide and finally let the bottom of the market fall out. Stone-hauling became more profitable, the "deucedly queer" practice of gathering snails ceased, and the local Indian shopkeeper sold more cigarettes in the next month than he had in a year. Everyone was happy.

My joy, however, was short-lived. I was not prepared to handle 2000 active, cannibalistic snails. Extremely humid weather was a great asset in collecting snails, but it made preparation for shipping exasperatingly difficult. When I placed 50 or more snails together in a box, they became ensnarled in a slimy, squirming ball. The specimens at the center were endangered by lack of oxygen, and I suspected that a certain amount of cannibalism would be practiced. Loosely wrapping an active snail in a small piece of dry paper was of little use, for the moisture from the mollusk's body would wet and weaken the paper and allow the snail to escape. The entire success of the mission

▼ David, maneuvering into position to attack and kill lumbering Goliath, the giant African snail

➤ TINY, isolated Agiguan Island in the Marianas, where the battle of the snails is on. Can little David rid the Pacific islands of the destructive giant African snail?

R. Tucker Abbott photo

hinged on my ability to dry the snails without killing them. Outside the *banda,* the night rain gently but persistently reminded me of the remarkable relative humidity. Inside, the cement floor was beaded with moisture, and the mosquito netting over my bed sagged in a clammy mass. When I finally went to bed, the sheets felt like two giant slabs of cold bologna and kept me awake long enough to plan the morrow's action.

The next morning I divided my catch into 20 groups and began sacrificing them in groups of 100 in various experiments to enforce estivation—a type of summer sleep induced by dry weather and lack of food and water. I turned an old-fashioned, wooden clothes hamper into an incubator-type drier by placing two kerosene lamps inside and leaving the door ajar for ventilation. Within three hours, the first hundred had withdrawn into their shells. I then loosely wrapped each David individually in a sheet of dry tissue paper. I worked into the wee hours of the morning and managed to wrap 500 before I fell asleep.

In the tropics, it does not take long to discover whether a snail is dead or alive. The warm climate, with the help of bacteria, brings on putrefaction in a few hours. The odor of a recently dead snail is at first extremely faint—a mere whiff of clam broth, not at all unpleasant. In a few hours, this is replaced by an oversweet, cloying perfume, which is still not particularly offensive. But the next stages are what one might expect, and no description can match the offense. Oddly enough, when decomposition has long ceased and the dead meat has become dried for several months, a new odor comes on which is very similar to concentrated bouillon cubes.

The day following the drying experiment, I began to smell clam broth; by evening, I could smell ripe snails. I unwrapped each of the tissue packages, tested with my nose 500 times, and separated the survivors—a dozen uneasy Davids.

I found the sun was putting in an appearance for an hour or so each midmorning, so the next day I placed 50 snails in a tray out in the open. The effects were as disastrous. After sacrificing 200 more specimens, I discovered that an exposure of more than 15 minutes of direct sunlight was fatal and that anything less would not induce estivation.

It was quite by accident and in a mood of resignation that I discovered a simple and quite unscientific way to make David sleep. I went to bed one evening, at a time apparently when the humidity was not unusually high, and let my snails roam at large about the *banda.* All night, they crawled in every direction. In the morning half of them had withdrawn into their shells, and the remainder were barely moving. The continuous loss of moisture in crawling over the relatively dry tables and walls was enough to convince David he should pull into his shell and wait for a more rainy day. A crawling snail lays down a carpet of moist mucus, and its foot actually glides over this film, not on the ground itself. This is the silvery trail you see left by snails on garden paths. It prevents dry dust and sand particles from adhering to the snail's foot and also protects the body from discomforting acids of the soil.

I was able to continue this technique when I returned to Mombasa the following week. The third floor of a modern hotel offered one of the driest rooms in town, and in three days of peanut-hunting for David, and with endless hours of unwrapping, sniffing, and wrapping, I was able to prepare my boxes for final air travel to the Pacific. To this day, I do not know if the hotel manager has been able to find an explanation for the silvery tracks on the floor, walls, and furniture of my room or to explain my extravagant use of rolls of tissue paper.

I did not accompany the first contingent of about 400 carnivorous snails to the Pacific. They were sent off by air express on a route that winged them over Egypt, Pakistan, India, Hong Kong, and finally the Marianas. In ten days, David spanned a distance that had taken Goliath nearly a hundred years to cover at a more than normal snail's pace. My share in "Operation Snailfolk" was for the most part complete, except for a later flight to the Marianas and arrangements for future shipments. I proceeded to Tanganyika and Zanzibar to carry out more snail investigations and to collect living *Scolia* wasps in connection with control measures against the destructive coconut beetle in the Pacific islands. In the meantime, the shipment of Davids was met at the Guam airport by Mr. Robert P. Owen, Staff Quarantine Officer at the Trust Territory Headquarters, who had been chosen to make the trip to Agiguan Island. The last phases of David's long and unusual journey was made by motor launch and rubber life raft.

Tiny, two and a half mile long Agiguan island sits like a giant aircraft carrier at anchor near the southern end of the long necklace of islands in the Marianas Archipelago. On an extremely clear day, Agiguan can be barely discerned from the heights of Guam Island, which lies some 74 miles to the south. From Saipan and Tinian, it is plainly visible to the southwest across a narrow stretch of water. Agiguan is elongate in shape and oddly terraced by eight steplike cliffs. The highest terrace is relatively flat and gives the illusion of a gigantic flight deck. On a rough day, the Pacific Ocean rings the cliff-bound island with a wreath of heavy, white breakers. There are no beaches on which landings can be made. During the Japanese occupancy after 1936, the only approach was at the southwestern end, where a giant straw basket was drawn up and down on a wire stretched from the top of the cliff to an anchor on the sea bottom. Later, rock stairs were built on the side of the cliff; but even now, approach must be made on a calm day.

On May 31, 1950, three weeks after their departure from East Africa, the *Gonaxis* snails were planted on Agiguan by Mr. Owen. The results of the experiment will not be known for many months, perhaps even years. David's first hurdle is to acclimate himself to his new environment. Should David's adopted island prove kindly and allow the increase of his kind, Goliath, the giant African snail, will be on the defensive for the first time since his invasion of the Pacific. The outcome of this battle between snails is dependent upon so many variable biological factors that placing bets at this time would be extremely risky. For the present, rockbound, isolated Agiguan guards the outcome of one of man's strangest experiments with nature.

HOME LIFE IN A SOVIET OUTPOST *continued from page 277*

burials. The place was several miles away, but he would be glad to show us if we would go in the launch. Following the Aleut's directions, we landed at Peresheek, where there was one house and some fox pens but no one there at the time. Having arrived at his destination, our guide now vaguely waved his hand in a semicircle and had no further interest in the matter. It was not a very likely location, and a thorough search convinced us this had been a false lead. Our Aleut friend had subtly obtained what he wanted—a ride in the motor launch!

Preobrazhenskoe is the only village on Meydni; and when we arrived offshore, the fog was so thick the village could not be seen. Fortunately, the fog lifted about dusk, and we were able to land. Director Zykov, an Aleut, was in charge of the village. He was an outstanding man on account of his size—without doubt the largest Aleut seen on the islands.

We were Zykov's guests for dinner at his home in a large room with a twelve-foot ceiling and a huge brick stove covering one end wall. Questioning the two oldest Aleuts on the island after dinner, it was found they knew nothing of any old sites and had never seen any artifacts. Both of these men had been born on Meydni and had never left it, not even to go to Bering. Zykov ordered some sea otter pelts brought in for our inspection. These beautiful and valuable pelts received no more care and attention than did common fox pelts.

Here, as at Nikolskoye, there is an electric-light plant, but during the summer months the plant at Preobrazhenskoe is shut down in order to conserve fuel. The fine-looking church had been boarded up and was not in use. Radio news was copied down in longhand, put into pamphlet form, and passed from family to family. After having made the rounds, the pamphlet was filed away by the Director. The news is 36 hours old when received.

Three Soviet whaling ships dropped anchor in the unprotected bay just before we left the next morning. They had no whales alongside, although we had seen many of them offshore from Meydni. We photographed these Soviet ships as we sailed close by on our departure, and one did not have to understand the Russian language to know that the crews were heaping vituperation on us for so doing.

Gladskuvskaya Stanovische is a small settlement of less than a dozen persons and is the location of the Sea Otter Experimental Station, under the direction of a biologist. This young man was keenly interested in his work and had, when occasion demanded, performed Caesarean operations on some of the animals. The laboratory was the only log building seen in the islands. Foxes, hogs, and cattle roamed around the buildings, and one exceptionally fine bull was staked out near some fox pens. The sea otter pens are built in a salt-water lake in which the tide rises and falls. One pen had been built in a fresh-water creek in order to determine if these animals can live indefinitely in fresh water. It would seem from the work being done here that the Soviets may possibly be recreating a profitable fur industry.

Returning to Preobrazhenskoe, we said good-by to Lieutenant Lazerof, for he was staying here until such time as he could return to Nikolskoye on a Russian boat. Lazerof had been of great assistance to us. In spite of the insufferable arrogance he displayed on coming aboard in 1937, his later actions proved he could be agreeable when he wished.

Archaeologically, our investigations had been negative. They did not indicate that the islands had been inhabited before the coming of the Russians. We had examined all the likely areas in the vicinity of our landings. Excavations were made at several of these places, but nothing pre-Russian was unearthed. In no case had the debris from any site accumulated to a depth of a foot.

However, the investigation of twelve small areas in seven days on two different islands appears to the writer to be inadequate for a definite determination as to the possibility of a pre-Russian occupation. Considering the fact that the mainland of Kamchatka can be easily seen from Bering in good weather and that Bering is reported to be visible from the mountains of the Peninsula, it would appear somewhat unreasonable to assume that the islands were uninhabited before the arrival of the Russians. A thorough investigation of the islands—something that might require a full season's work or even more—seems essential if a definite determination is to be made.

However, Dr. Hrdlička, a leading authority on anthropological matters, has stated that these islands were "not a stepping stone in the peopling of America." Dr. L. Stejneger, who made several visits to the islands for biological purposes prior to 1922, expressed the opinion that there was no pre-Russian population.

While making no claim to be an authority on this matter, I believe that further work is necessary in order to confirm Dr. Hrdlička's statement. If, as indeed may be possible, the islands were not peopled before the time of the Russians, it would seem to indicate that the Kamchatkan Peninsula was very sparsely inhabited, if at all, until comparatively recent times.

The Soviet islands appear to be fully utilized. All the different animals are raised under the supervision of scientists. The foxes, for instance, are fed, branded, and counted each year. The islands are divided into four sections, with four Aleuts in charge of and responsible for all the animals in their section. The villages were well kept and in good repair, the natives reasonably well clothed, the homes clean and neat. Vegetables were successfully raised at Nikolskoye, whereas in the Aleutians, with almost identical climatic conditions, it is claimed the season is too short.

It must be admitted that many favorable impressions were received from the Soviet islands although none were anticipated. Nevertheless, these favorable impressions were more than offset by something at first intangible. This intangible something permeated the air at Nikolskoye in particular and, to a lesser extent, in the outlying settlements. It took some time before realizing this oppressive sensation was caused by fear. Everyone appeared afraid of breaking some rule or of not doing the right thing. It was the accumulation of small incidents that brought to mind this fear complex. For instance, the men of the "army" refused to accept cigarettes when offered; Antipov, a gregarious person, hardly ever talked in the presence of Lazerof; and Aleuts always jumped into immediate action at any word from an official.

It would seem that actions and words could be misconstrued; therefore, actions and speech were restricted in the presence of others. Only at the reception parties, when drinking was taking place, did the Russians act without restraint. Lazerof, as head man, was afraid of no one on the island, but he gave the impression of being insecure, of being afraid of doing the wrong thing, which could presumably bring censure or worse from Petropavlovsk. This feeling of instability in Lazerof may have accounted for his obnoxious attitude on our first arrival aboard the "Tallapoosa."

Had it not been for this all-prevailing fear, this subjugation of freedom, it might have been said that here was colonization at its best. Unfortunately, it was merely typical Soviet totalitarian regimentation—successful indeed but only through force based on fear.

NOTE: The views I have expressed in the last three paragraphs are my firm convictions. However, the domination by fear was not noticed by at least one other visitor to the islands. An anonymous article in the Roman Forum *for June, 1940, differs in part with my own impressions.*

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Continued from page 247

and plausible outline of New Zealand culture history. His evidence makes it clear that the first inhabitants were Polynesians, a part of the earliest wave of distribution that spread from the Society Islands to the outermost reaches of Polynesia. These first-comers probably reached New Zealand around A.D. 950, bearing a culture that survived in various fringe groups while undergoing modification and change in the central homeland.

These pioneers in New Zealand, as their camp sites abundantly demonstrate, found a rich source of food in the moa—and in the bones of this species of bird, a valuable material out of which they fashioned a variety of articles. This first culture, Mr. Duff takes pains to stress, is not the conventional Maori one we commonly associate with New Zealand. It is a forerunner—a stage out of which, with additions brought by succeeding settlers from Tahiti, the subsequent Maori developments arose. This process as Mr. Duff envisages it was in part a self-propelled phenomenon, although the stimulus of new ideas and environmental adjustments are also recognized. In this reconstruction of pre-European culture history in New Zealand there is no place for the Melanesian influences that some scholars have suggested. It is a purely Polynesian affair, the local growth and evolution of an early version of Polynesian culture.

Much of the author's argument is based upon a comparative study of the other local cultures of Polynesia. In particular he leans heavily on the evidence provided by the distribution of adze forms and types of ornament. He conceives of culture spreading through Polynesia concentrically from a center located in the Society Islands, thus depositing the earliest forms on the outermost periphery of the area. There is much to be said for this hypothesis. It is, however, questionable how far this useful device can be carried.

Mr. Duff's book, the first on the subject, is a major contribution. It is readable, interesting, detailed, and critical. It merits careful consideration by anyone seriously interested in Polynesian history.

HARRY L. SHAPIRO

THE NEW PHYSICS

- - - - - - - - by Sir C. V. Raman

Philosophical Library, $3.75
144 pp.

THIS book is written by a noted Indian physicist, a Nobel Prize winner, and is phrased for the lay public. These brief essays were originally delivered as radio talks and, of necessity, touch only on the highlights of the broad subjects they cover.

The reader learns something of the building blocks the physicist has at his disposal and, through easy stages, is brought up to the threshold of present-day achievements. The average reader would find the going so hazardous beyond this threshold, dodging heavy particles, mesons or cosmic rays, or sunk without a trace by supermathematics, that the author wisely gives the reader but a peek. "The progress being made is so rapid that even the most eminent leaders of the science have had scarcely time to comprehend or understand, in its totality, the meaning of all the new knowledge."

To this reviewer the concluding chapters, "The Future of Physics" and "The Scientific Outlook," are outstanding in their lucid summary of advanced physics for the layman.

Much of the data given in this book should already be known to the educated reader. The author discusses light and color, the soil, water, weather, atmospheric electricity, et cetera. We have come a long way in understanding and using phenomena in these categories. Perhaps some of the older physical concepts were fallacious in the light of modern ideas, but for many of these obvious manifestations a weak explanation did not stand in the way of some degree of progress. The ultimate degree of progress with the new physics as the rational background may be something quite outside our experience.

For the most part the early chapters treat of things a man can see, touch, or experience by a means he can understand. Therefore the older school of thought does not seem so quaint. The new physics deals with abstractions and intangibles. To the layman the quaint thing about this picture is that the new physics works.

HAROLD E. ANTHONY

UNDISCOVERED SCOTLAND

- - - - - - - - - by W. H. Murray

The Macmillan Co., $3.50
252 pp., 37 illusts.

THIS book was written by a mountaineer—an expert at his craft—especially for his fellow-craftsmen, and at first the technical terms used in describing the mountains he has scaled may be slightly confusing to the layman. As one reads on, however, such matters take up their correct relationships, and one becomes absorbed with the author's smooth and easy writing, his excellent and descriptive choice of phrase, and the rich guttural Gaelic names of the areas and peaks of which he tells. Now and then a pawky little vein of humor creeps into the writing as he compares himself, always to his own disparagement, with his climbing companions. And who, raised on John Buchan or Compton Mackenzie, could long feel a stranger to such places as Glen Affric, Coire nan Lochan, and Garbh Bheinn?

There are various anecdotes in the book, but in the main it is a series of descriptions of climbs in the Northern Highlands. The "undiscovered" part of the title refers to the glamorous and glorious land atop the mountains and peaks, mainly near the district of Glencoe, known only to Mr. Murray and his fellows. A number of the ascents are "firsts," and the author has deposited his records, maps, and diagrams with the Scottish Mountaineering Club for the benefit of later climbers.

To me, whose mountain-climbing has been done only in tropical surroundings, the thought of ice-covered rock is little short of terrifying. However, these perils are modestly dismissed by Mr. Murray, and, indeed, he sometimes seems to prefer them. The Great Slab of Leac Mhor, a rock-climb, or perhaps the climbs on the Island of Rum, sound rather less fearsome to me, but I would not call any of them a gentle country walk, ice or no ice. It is difficult to comment adequately, because one wishes to draw attention to so many different facets in the book.

All through it there is the entrancing force of sheer, unqualified enthusiasm; one appreciates the fact that to a mountaineer, as perhaps to a scientist, the world has nothing higher to offer than the attainment of his goal. And unless he is striving toward it, he is just wasting time.

The photographs with which the book is illustrated are excellent. To anybody with a lust for achievement and eyes to imagine, I recommend it heartily.

GEOFFREY M. TATE

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PATIENCE REWARDS THE ANTLION

continued from page 263

merely goes to work weaving silk about itself.

But the ant lion is under fine shifting sand, and if it did not use a special technique, its cocoon would contain not only itself but a lot of sand. If you examine the cocoon of an ant lion with a hand lens, you will see that there is no sand *inside*. The secret was exposed in 1884 in Germany by Redtenbacher, who says, "The larva while spinning lies on its back with its abdomen curved ventrally and, while the sticky thread is issuing, moves the spinneret about in circular, spiral and confusedly irregular paths. Since the sand grains are thus cemented together by the sticky strands, there arises a confused band of sand, which is gradually consolidated to form a hemisphere . . . Later it turns over and the lower hemisphere is completed and attached to the upper one." Thus the creature builds a cocoon without getting sand inside. Within this cocoon, buried in the sand, the larva transforms into the pupal stage, and for nearly two months it remains in the "sleep of transformation."

One day, however, the side of the cocoon splits open, and the pupal ant lion pushes itself to the surface of the sand. Its skin ruptures along its back, and out comes a bedraggled creature. At first it is pale and delicate, but within a few hours its integument hardens and the limp and crumpled wings expand into transparent, gauzy membranes that carry the transformed creature high over the sands where it had its humble beginning. The lowly, ugly creature that was only a third of an inch long has transformed into a winged adult approximately three inches across and somewhat like a dragon fly in general appearance.

After her years at the bottom of a pitfall, the female has only a limited time, a few days, in which to mate and return to the sand to lay her eggs. Like an insect Cinderella, her period of gaiety is quite short.

BULLDOZERS VS. TROWELS

continued from page 253

growing season in the higher country, although the water supply was more adequate there, was too short for corn to mature. The small number of favorable fields for planting further limited the population this area could support.

Long drought periods reduced the natural vegetative cover, induced soil erosion and the channeling of valley floors—arroyo cutting—and this in turn led to the lowering of the normal water table. The heavy concentration of people in Chaco Canyon, where planting fields were limited, probably ended in migration from the above causes, prior to commencement of the great 1286-1299 drought of 23-years duration which largely and finally depopulated almost the entire area of the Colorado Plateau.

Important Notice

Readers are reminded that Natural History is not published during July and August. Those who expect to be away after September 1, however, and wish to have their September issue sent to a temporary summer address are requested to notify the Membership Secretary. Please give also the date of expected return to permanent address.

We know some of these facts because archaeologists accompanied the construction crews of the El Paso Natural Gas Company. Without the archaeologists, the pipeline would have been just another ditch, and a very destructive one, however benefical. Luckily, a man with Dr. Nusbaum's background and interests was on the spot, and he knew the significance of what was about to happen. His connection with archaeology began in 1907, when he went on an expedition to Mesa Verde which established the present boundaries of that National Park.

He has been associated in various capacities with museums interested in Southwestern anthropology. He organized and was the first director of the Laboratory of Anthropology in Santa Fe, New Mexico. He is now Senior Archaeologist for the National Park Service and Consulting Archaeologist for the Department of the Interior.

The men of the two crews—Francis Cassidy and Bill Bullard of the New Mexican crew, and Paul Ezell and Wesley L. Bliss of the Arizona one—were all graduate students in anthropology at various universities. All had field experience in Southwestern archaeology. As a result of applying this experience, 146 sites have been salvaged.

An unknown quantity of sites are still threatened by pending projects in various parts of the country. This job covered 451 miles; 2790 more miles of pipeline are contemplated in the Pacific Northwest and 3650 miles in the Southwest, not to mention other construction jobs. Even if these pipelines encounter only a third as many sites, over 500 more sites are doomed.

The example of co-operation between business and science furnished by the pipeline can be extended to cover other potentially destructive work. The bugaboo of cost is frequently raised. Archaeologists as well as laymen may be interested to know that this whole scientific program cost approximately one twentieth of one per cent of the total for the construction job. Certainly this was a small price for saving the evidence of cultures vital to the reconstruction of man's past.

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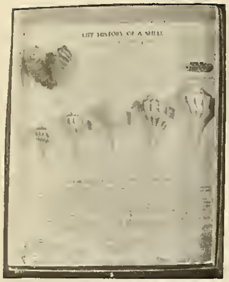
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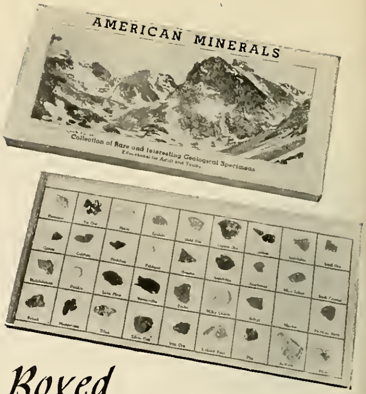
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LETTERS

The "Ape" That Wasn't an Ape

Sirs:

Some years ago I read that a large and strange ape, as depicted in the accompanying illustration, was discovered in Venezuela. An ape, as distinct from a monkey, would seem to be in disagreement with what we know of animal evolution in South America. I have not been able to find any further information regarding the beast in books or scientific magazines. Could you identify the creature and tell me the truth about it?

I. Camara

Rio de Janeiro,
Brazil

The following information is offered by Dr. G. H. H. Tate of the American Museum's Department of Mammals:

This fantastic story of an alleged South American anthropoid began in 1929. In a variety of publications, Dr. George Montandon attested to the fact that Dr. Francis de Loys, a French traveler in western Venezuela between 1917 and 1920, had reported the presence of such animals. Montandon reproduced in support of his contention a photograph of a large dead spider monkey seated on a kerosene case with its tail parts concealed. Montandon proceeded to solemnize this "discovery" by giving the creature the technical name of *Ameranthropus loysi.*

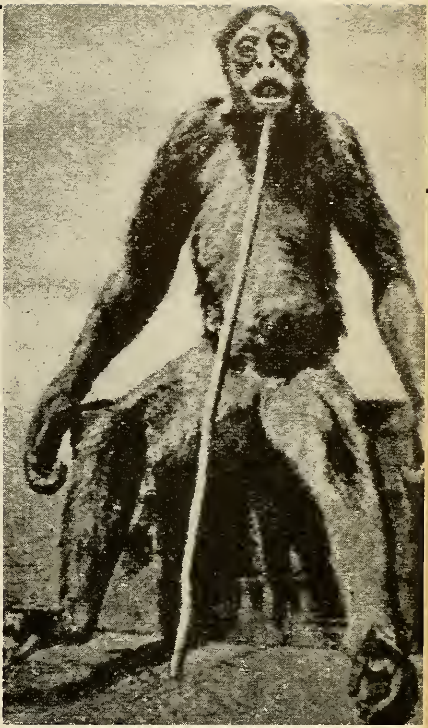
Rebuttal was quickly forthcoming. Sir Arthur Keith in *Man,* vol. 29, pp. 135-136, easily demolished the "new anthropoid." Keith stated flatly that the animal was an *Ateles* (Spider Monkey) and objected to the offhand way in which Dr. Loys remarked that the tail was completely absent—"as if it were a matter that required nothing more than mention . . .

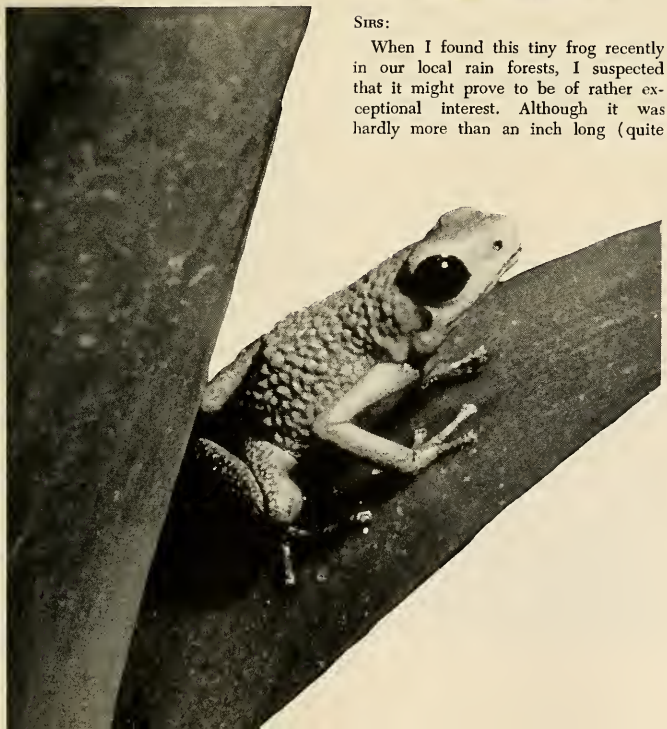
"A photograph of the animal from behind would have clinched matters," Sir Arthur Keith continued. "The problem of identification is further complicated by the discoverer, who has, after removing skin and skull, lost them . . . Thus the only original document . . . is the photograph on which Dr. Montandon's description is based . . . "

Other scientists, including Ashly-Montagu, expressed equal doubts.

In 1930, Dr. Montandon answered his critics with a lengthy summary *(Archivio Zoologico Italiano* [Torino], vol. 14, pp. 441-459), attempting to bolster up his argument on the basis of the large size of the monkey. He cited no less than 20 papers on *Ameranthropus* in his bibliography.

No further response was forthcoming.





Frogs and Arrow Poison

Sirs:

When I found this tiny frog recently in our local rain forests, I suspected that it might prove to be of rather exceptional interest. Although it was hardly more than an inch long (quite a common size for tropical American frogs, by the way) its coloring was quite spectacular. I photographed the handsome sprite, and sent the picture to my good friend Dr. E. R. Dunn, of Haverford College, who was kind enough to identify it as *Dendrobates pumilio* Schmidt. He tells me that this photograph is the first indication of the occurrence of the species on the Pacific slope of Costa Rica. Although I have never seen it here before, it is apparently common enough in some localities on the wet Atlantic slope of Nicaragua, Costa Rica, and Panama. The first, and by far the best account of these creatures is that by Thomas Belt, who saw them in Nicaragua nearly three-quarters of a century ago. Belt had become considerably interested in warning coloration in insects (as typified, for example, by the brightly colored, but ill tasting Heliconid butterflies). So far as we know, he was the first to observe warning coloration in amphibians; hence his account, quoted below, has considerable historical significance.

"In the woods around Santo Domingo there are many frogs. Some are green or brown and imitate green or dead leaves and live amongst foliage. Others are dull earth colored, and hide in holes

▲ **Builder of dunes:** wild sea oats along Bogue's Bank in North Carolina

and under logs. All these come out only at night to feed, and they are all preyed upon by snakes and birds. In contrast with these obscurely colored species, another little frog hops about in the daytime dressed in a bright livery of red and blue. He cannot be mistaken for any other, and his flaming vest and blue stockings show that he does not court concealment. He is very abundant in the damp woods, and I was convinced he was uneatable as soon as I made his acquaintance and saw the happy sense of security with which he hopped about. I took a few specimens home with me and tried my fowls and ducks with them, but none would touch them. At last, by throwing down pieces of meat, for which there was a great competition amongst them, I managed to entice a young duck into snatching up one of the little frogs. Instead of swallowing it, however, it instantly threw it out of its mouth, and went about jerking its head as if trying to throw off some unpleasant taste."

It is perhaps of some further interest that the Indians of Darien Province in Panama and in the adjacent Colombian Choco have long been aware of this peculiarity and have used this frog, and a closely allied blue and black species, for the manufacture of an arrow poison. Apparently a number of the frogs are spitted on a stick and toasted over a fire, the exudate from the skin providing the active principal. So far as known, this is the only nonvegetable arrow poison in the American tropics.

Paul H. Allen

Esquinas Experiment Station
Costa Rica

Island Builder

Sirs:

Along long Bogue's Bank, as natives call the barrier isle on the coast of North Carolina, the strong sea winds are constantly fighting to level the sand dunes. Although there are shrubs, dwarf trees, and creeper vines growing up the landward side of the dunes, these stop short below the top—unable to withstand the rigor of salt sea-spray and wind-blown sand. But alone atop these dunes stands the wild sea oats or spangle grass *(Uniola paniculata)*, which gracefully float their panicles of flowers upon salt-poisoned winds. It is this head-high grass that has stopped the sand and built the Carolina strand.

Paul D. Harwood

Ashland, O.

A Poisoned Valley

Sirs:

Under the title "An Invisible Deathtrap," you called attention to a bubbling pool in Yellowstone Park whose gases were fatal to a considerable number of small animals (October, 1950). I ran across a reference to another "Poisoned Valley" in a new chemistry text, *General Chemistry* by P. W. Selwood. This valley is three miles from Balor, Java, and it was said that a dog was observed to fall unconscious in ten seconds and to die in seven minutes. One chicken thrown into the area was dead when it hit the ground and the other lived one and one-half minutes. In the valley were noted skeletons of " . . . human beings, tigers, pigs, deer, peacocks, and all sorts of birds," according to observations in 1830. I am wondering whether you can give me further information about this spot.

James S. Legg
Associate Professor
Biology Department

Whitworth College
Spokane, Washington

The following comments are offered by Dr. John T. Zimmer:

According to the original description referred to (from the *Edinburgh New Philosophical Journal* of 1831), this valley was considerably larger than the pool described in Natural History, for it measured about half a mile in circumference and from 30 to 35 feet deep. The sides were covered with trees, but the bottom was flat and without vegetation. A suffocating smell was noted both outside and inside the hollow, but not at the rim. The party descended to within 18 feet of the bottom without difficulty in breathing but did not attempt to go lower. Smoking fumaroles existed not far from the road at the foot of the mountain.

The exudation was described as carbon dioxide by M. Neumayer, writing in *Erdgeschichte* in 1920. Such gases of volcanic origin (carbon dioxide and hydrogen sulphide) are apparently plentiful in

Continued on page 335

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The Magazine of the American Museum of Natural History

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VOLUME LX—No. 7 — **SEPTEMBER, 1951**

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From a color photograph by Roy C. Wilcox

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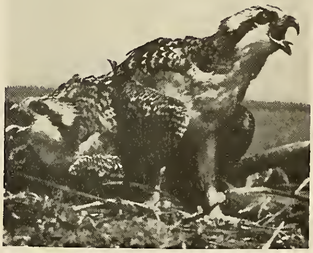
You will find Natural History *Magazine indexed in* Readers' Guide to periodical Literature *in your library*



THE COVER THIS MONTH

One of our interesting birds of prey is the Osprey or Fish Hawk, shown here in an unusual color photograph taken by Mr. Roy C. Wilcox. The North American representative of the species is found throughout the United States and most of Canada and Alaska, wintering farther south, from the Gulf coast as far as Paraguay and northern Argentina. Since it feeds principally upon fish, it makes its home near water, salt or fresh. It can sight its prey from heights of 30 to 100 feet and drops with a splash, striking the water breast-first, sometimes going completely under. The fish may weigh up to four pounds or more and is carried in the bird's talons, headfirst. Often the Osprey is victimized by the Bald Eagle, which forces it to drop its prey and then catches the food in mid-air before it reaches the water.

The nest is usually placed high on a tree or pole but sometimes on the ground. It is a bulky structure, sometimes as much as 20 feet across and 6 feet high, composed of nearly every imaginable sort of material. It is occupied year after year, sometimes for as long as 40 years, with additions made until its weight may break down the support.

John T. Zimmer

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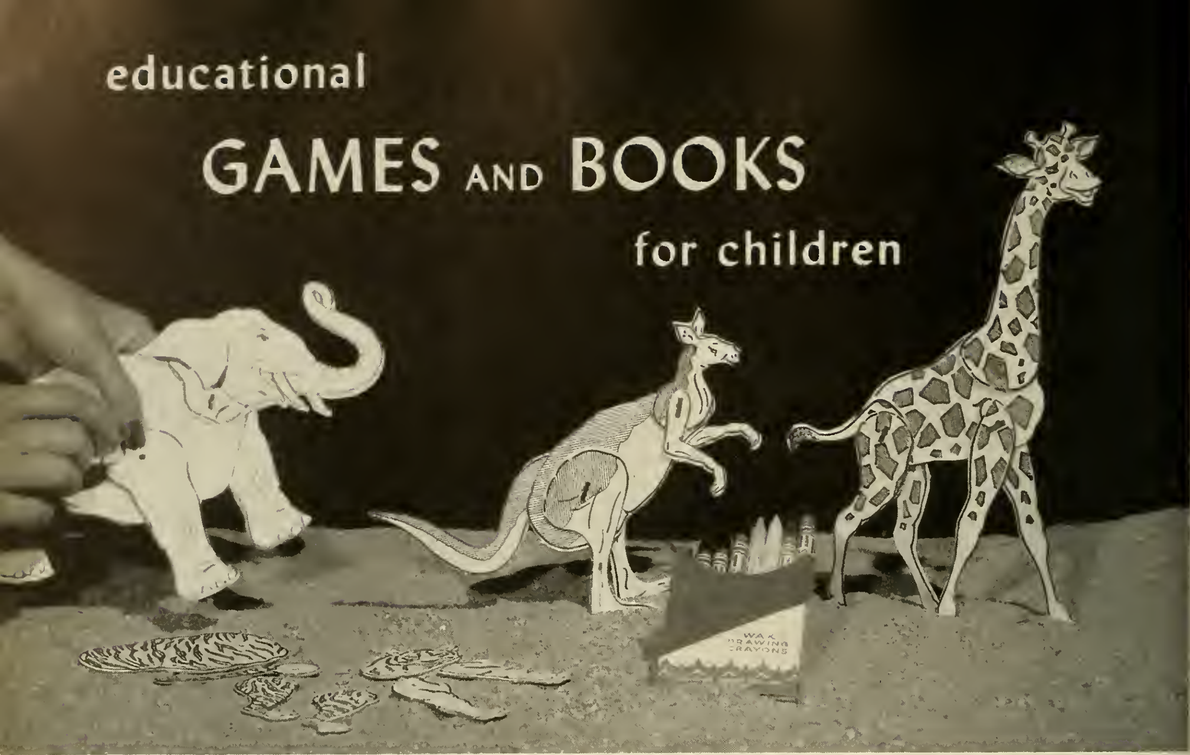

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AMERICAN WILDLIFE AND PLANTS

- - - - - by Alexander C. Martin,
Herbert S. Zim, and
Arnold L. Nelson

McGraw-Hill Book Company, Inc., $7.50
500 pp., over 700 illusts.

THE title page of this book describes it as "A Guide to Wildlife Food Habits: the use of trees, shrubs, weeds, and herbs by birds and mammals of the United States." Since it has been prepared under the direction of the United States Fish and Wildlife Service, it is authoritative and draws upon the most exhaustive file of such data in existence.

The subject is developed in a logical manner. The reader is informed about the many ways in which animals derive food from plants, the availability of this food, food preferences, the variation of food habits with the seasons, the importance of plant life as protective cover, and so forth. Cultivated crops play an important part in the dietary plan of some animal life, and, to some degree, many of these animal boarders pay for their keep in controlling factors inimical to the desired crop.

There is a chapter on wildlife food-habits studies to tell how the basic data for the book is secured, and this is followed by another chapter with instructions for interpreting the information in the book.

Most of the pages are devoted to covering the plant-animal relationship from two angles. The first approach places the emphasis upon the animals. They are taken up systematically—birds, mammals, fishes, amphibians, and reptiles, treated as the most useful identifiable group, often as species, and the plant food is listed for each. The other presentation is from the plant aspect. The plants are systematically treated, and the animals that feed upon them are arranged in the proper pigeonholes. In this way the information desired may be sought from either side of the relationship.

Helpful bibliographies appear frequently at the end of each significant discussion. The book is well illustrated by excellent line cuts and by maps to supplement the text. There are more than 700 illustrations, and in every way the book is a credit to the publisher.

This is a very good reference for anyone who loves nature or wants to know more of what is happening about him. It should prove a classic in its field and a must for every naturalist.

HAROLD E. ANTHONY

NATURE'S WAYS

- - - - by Roy Chapman Andrews

Illustrations by Andre Durenceau
Crown Publishers, $3.75

206 pp., 144 illusts. (72 in full color)

THIS book of attractive appearance is also a pitfall for the unwary reader because of errors (obvious to the expert) and misleading statements that create erroneous impressions.

In this brief review it is not possible to give much on the merits and faults of the book. Because the faults are more likely to escape the average reader than are the creditable features, more space must be given them.

The book is well printed, the color plates catch the eye, and trustworthy data on a wide variety of topics is given. Under these circumstances what a pity that Homer nods. One gathers that the book is the product of several minds, and Dr. Andrews may not be directly responsible, for example, that the African antelope, on page 29, are identified as the American pronghorn. Many readers will catch this blunder at once; for them no harm has been done.

But there are less obvious misrepresentations to fix an incorrect idea in the mind of the reader. A deplorable striving for the dramatic and unusual appears in some section headings. "The Bear that Lives on Ants" tells about the ant bear, not a true bear at all. But this confusion of names is not clarified, and a child will believe the beast is a bear. The most aggravated example of misdirected identity deals with "Porpoises Once Lived on Land." Of course this is not so. Ancestors of porpoises lived on land, but they were not known as porpoises then nor did they remotely resemble what we know as porpoises today. Other instances of this play on words do violence to accurate natural history.

It is somewhat surprising that the speed of the deer botfly is given at 800 miles per hour plus. This absurd claim of Dr. Townsend was pretty well exploded by cold analysis and scientific analogy some years ago. It is to be doubted that the insect can fly any faster now than it did then.

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NATURE THROUGH THE YEAR

- - - - - - - - - - by Frances Pitt

Macmillan and Co., $3.75
300 pp., 133 illusts.

READING this book is akin to spending a year in the English countryside with a friend who is a keen observer and a good photographer, and who has the ability to describe her observations in a simple and pleasant manner. Miss Pitt takes the reader, month by month, from January to December, on a journey through Nature's ever-changing year. The book is organized along the lines of a very informal journal kept not by a scientist but by a person who loves the countryside and who has learned to note the interesting behavior of its many animal inhabitants. Not all the creatures are wild; interspersed with stories of the wild animals are tales of the inhabitants of Miss Pitt's barnyard.

The book is amply illustrated with photographs taken by the author. The only regret is that they are all black-and-white. The deep feeling Miss Pitt seems to have for animals is sometimes revealed in her interpretations of their behavior. Occasionally she attributes to some of the subjects traits that are human and are not necessarily animal. Those who want their nature study on a strictly scientific basis may object to this, but most readers will find the "flavor" of the English countryside, which this book has captured, ample reward for their time.

JOHN R. SAUNDERS

WATCH OUT FOR THE WEATHER

- - - - - by Jacqueline Berke and Vivian Wilson

The Viking Press, $2.95
256 pp., 31 illusts.

ARE you planning to retire, go into business, get married, or go on a vacation? Then be sure to consult your meteorologist! According to the authors of *Watch Out for the Weather,* we are not watching out as much as we should, and all of us could profit by taking fuller advantage of known weather effects.

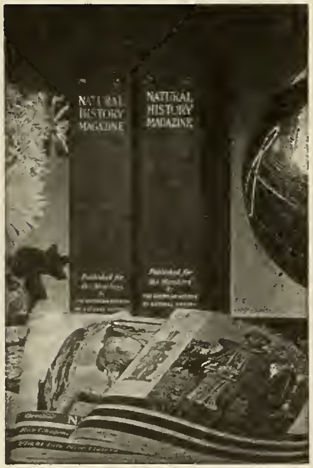
Furthermore, the authors are convinced that progress has been impeded in many fields due to the failure of lawyers, educators, physicians, architects, and business men to reckon properly with weather and climate.

Jacqueline Berke and Vivian Wilson have written a most interesting book in which the main emphasis is on the present status of medical meteorology and "climotherapy." Interspersed are chapters on artificial rainmaking, atmospheric pollution, and the application of weather science to business and architecture. A chapter entitled "Modern Weather Men" does not discuss such pioneers of modern meteorology as Rossby and Bjerknes but contains instead biographical sketches of Prof. Ellsworth Huntington, the great geographer and climatologist, and two physicians who have also pioneered in the study of the influence of weather factors on human health and disease, Dr. Clarence A. Mills of Cincinnati, and the late Dr. William F. Petersen of Chicago.

The authors are concerned over the apathy of physicians and others to the potential great rewards that seem almost certain through a proper study of weather and climate and their effects. Their concern is illustrated in a stinging rebuke to those who have located our National Leprosarium in Louisiana "where the climate does its best to ape the tropics," when there is some evidence suggesting that leprosy loses its virulence when imported to the more northerly climates of Minnesota and North Dakota.

On the other hand, they were perhaps pleased by the trend indicated in the series of papers presented last January when physicians and meteorologists joined hands in New York at a symposium on medical meteorology sponsored by the American Meteorological Society.

C. P. MOOK



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THE MIGRATION OF BIRDS

- - - - - by Frederick C. Lincoln

U. S. Fish and Wildlife Service
Dept. of Interior, Washington, D. C., 30¢
102 pp., 23 illusts.

FOR many years Mr. Lincoln has been writing about the migratory movements of North American birds, utilizing the vast accumulation of records—now containing over three million entries—maintained by the Service of which he is an official. In the present circular he has summarized much of the preceding material and brought it up to date, writing in broader terms. More detailed discussions will be found among the papers by numerous authors listed in the bibliography appended to the present account.

Much has been learned in recent years concerning this fascinating subject, but there are still problems for which satisfactory answers are not yet provided. Chief among these are the factors that periodically induce and regulate the migratory movement and the marvelous powers of orientation that birds possess. We know more about the routes of migration and the "flyways," the speed of flight, and the very different speed of migration, the altitudes of flight, vagrant movements, and similar matters. As an interesting and useful summary of much of our present knowledge and theory regarding North American birds, Mr. Lincoln's circular can be thoroughly recommended.

John T. Zimmer

AMERICAN RESOURCES—
Their Management and Conservation

- - - - - - by J. Russell Whitaker and Edward A. Ackerman

Harcourt, Brace and Co., $6.75
497 pp., 76 figs.

THIS book fully lives up to its title. Although the coverage of any given aspect of these vast problems is necessarily brief, the scope is all-inclusive. The treatment is factual and, while the authors do not predict any dire catastrophe to the country in the near future, they make it abundantly clear that we shall pay an increasingly heavy price for our lack of wisdom in handling our natural resources. How the necessary changes are to be brought about within the framework of our democratic, private enterprise system, if education and enlightened self-interest fail or are too slow, is the great unanswered question that assails the reader on every page.

In the 43 years since Theodore Roosevelt called the White House Conference of Governors to consider these problems, we have made great strides in working out methods of preventing and fighting forest fires, conserving soil, and managing forest and grassland communities and their wildlife. However, these techniques are only effective in so far as landowners can be persuaded to make use of them or Congress will appropriate funds to apply them on public lands.

American Resources demonstrates very clearly that conservation is today a political and social problem. Education is one aspect; but it seems evident that in some cases the state, through land-use zoning and other regulatory steps, will have to protect the interests of future generations against those individuals of our own who are tempted to reap quick profits at their expense.

The book deals first with cultivated land and then in turn with grasslands, forests, water, and wildlife. The nonrenewable resources field, especially the problem of mineral fuels, is surveyed; and the recreation value of many resources is also recognized.

The footnote references constitute an excellent guide to many of the basic conservation documents of recent years. The wealth of maps, statistics, and specific results of recent studies of the rates of resource exhaustion make this an invaluable reference book for conservation chairmen and others who seek to present the overall story of conservation to the people of their community.

Richard H. Pough

THE HUMAN SPECIES
A Biology of Man

- - - - - - - - by Anthony Barnett

W. W. Norton & Co., $3.75
266 pp. 16 plates

MR. BARNETT has undertaken a difficult job in attempting to write a biology of man in 266 pages, especially since his selection of topics includes such rich fields as genetics, embryology, evolution, race, eugenics, sex differences, evolution of human society, food, and population dynamics. Even as an introduction to the subject, which this book obviously is intended to be, the problem of selection and compression is a formidable one. It would, therefore, be unfair to criticize the author for the omission of topics that might have been included. In fact, it is difficult to see how any more could have been added in the limited space.

Within the limitations suggested above, Mr. Barnett tells the reader a great deal

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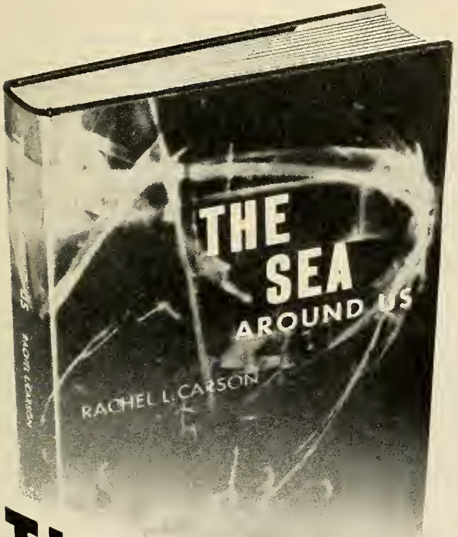

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—AUSTIN H. CLARK, staff member, Smithsonian Institute, in *Saturday Review*

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WHAT MAKES The Soviet

Sovfoto

▲ **Emblems old and new.** Not until eighteen years after the Revolution was the two-headed eagle—symbol of the Tsars—removed from the Spassky Tower of the Kremlin wall. Here the five-pointed star with the hammer and sickle is replacing it

TODAY the safety of all civilization may hinge upon our ability to develop ways through which the behavior of the members of any large modern society can be made intelligible to the members of other societies. At the present time when nations want to agree on a course of action—in problems as varied as the establishment of an international control system for rare metals or the training of reliable civil aeronautical pilots—there is no assurance that the representatives of any one country will communicate what they *mean* to communicate to the representatives of any other country.

During World War II, we learned to try every method, however unlikely, to find a solution to problems that might mean the difference between survival and annihilation.

Sovfoto

The Red Square of Old Moscow, around 1890, and the same locality after the construction of Lenin's tomb. Crowds wait in line to pay homage to Lenin's memory. The stone execution block and the monuments to the liberators of Moscow in 1916 have been moved to make room for the parades

Character?

By MARGARET MEAD

Associate Curator of Ethnology,
American Museum of Natural History

Embryologists were set to stopping submarine warfare, crystallographers to discussing national policy. Now in this uneasy peacetime, most scientists have been sent back to their traditional tasks, and the intellectual ferment that occurs when an old problem is tackled in a new way has been allowed to subside.

But not altogether, for during the last three years the American Museum of Natural History has been taking part in research on the contemporary character and culture of the Soviet Union, which might at first seem almost as fantastic a venture as having an expert on biochemistry devise methods for classifying Oriental philosophies. If we say that the essence of the natural-history approach is first-hand observation of living creatures in their natural settings, it would seem that any attempt to come to conclusions about conditions behind the Iron Curtain is ill-placed in a natural history museum. Surely this is a task for those who work, not with living things, but with the traces modern man leaves on paper—government documents, production figures, ideological manifestoes. The museum scientist studying a primitive people is accustomed to noting the way the wrists of a hunter become taut on his bow or the way a native woman keeps her balance when her punting pole catches in the weeds. What bearing have these techniques of direct observation on the study of the effect on young Soviet citizens of an official statement that the Soviet Union has just "invented" an exact replica of some American machine, or with the meaning of a trial in which, when the accused refuses to confess, the trial is interrupted and is resumed only with his full confession to all the charges? How can the behavior of members of a modern society with a long history be illuminated by any method ex-

(EDITOR'S NOTE) Challenging the old hypothesis that differences in national character are due to inherited factors, this article is an attempt to interpret in popular form the social, educational, and historical forces that have molded the personality of the Soviet citizen. Three years ago a group of research workers in anthropology, sociology, psychology, and political science joined to work on a project called Studies in Soviet Culture. The aim was to gather as much information as possible from refugees, current Soviet literature, motion pictures bearing the official stamp, political manifestoes, and other vehicles of Soviet philosophy, and on this basis to analyze the Soviet national character. All the original work was done in the Russian language.

The various lines of inquiry are being drawn together by the author of this article, whose book, Soviet Attitudes Toward Authority, *will be published within the month by McGraw-Hill. The book will give a report of the first year's work on this project and will contain an account of the personnel and methods of the research group who contributed to it.*

Readers will recall Margaret Mead's many writings, from Coming of Age in Samoa *and* Growing Up in New Guinea *to her recent* Male and Female, *all of which demonstrate her facility in applying the methods of anthropology and psychology to elucidate the interaction between education and original nature.*

Frederic Lewis photo

▲ Breakfast room in the Winter Palace of the Russian Tsars in St. Petersburg. The transformation of rooms like this is an important symbol of the Soviet revolution

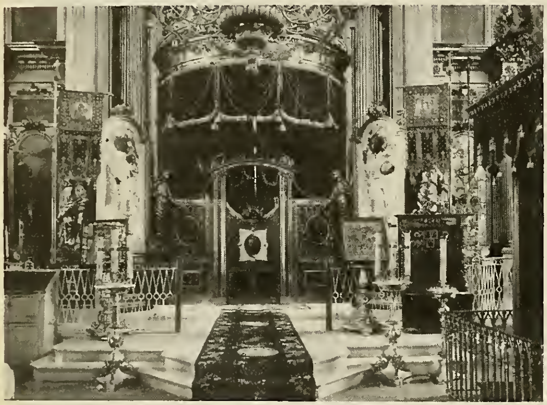
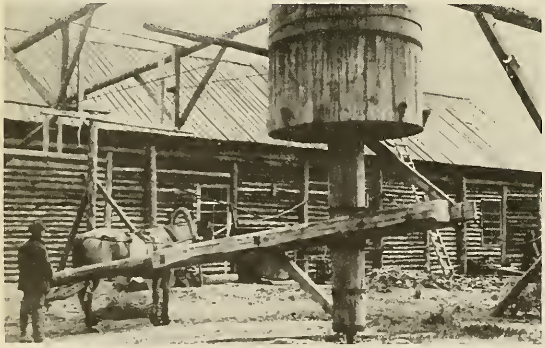


Photo by Herbert, from Frederic Lewis

▲ The beautiful altar of the Solovesky Monastery in Moscow



Hirz photo, from Frederic Lewis

▲ This photograph, taken in the Vasilievsk region in Russia, shows the primitive methods still being used for the mining of "black gold"—oil. Crude devices of this sort co-exist with the most modern extraction machinery

➤ A scene in the Stalingrad tractor factory in 1946, where tractors are produced according to modern assembly line methods. American engineers helped to build this factory. It reached full production in 1932

Ewing Galloway photo

▲ Reading room for Soviet workers in former palace of the Tsar. The plant in the corner parallels the one in the preceding photograph. This is the Livadia where Roosevelt stayed

ВНЬЕ ПРАЗДНИКИ

Ewing Galloway photo

▲ An antireligious book exhibition in Moscow, arranged by the Pioneer's Organization in the "Red Banner" Club of the workers of the Poveletsk branch of the Moscow-Kursk railway

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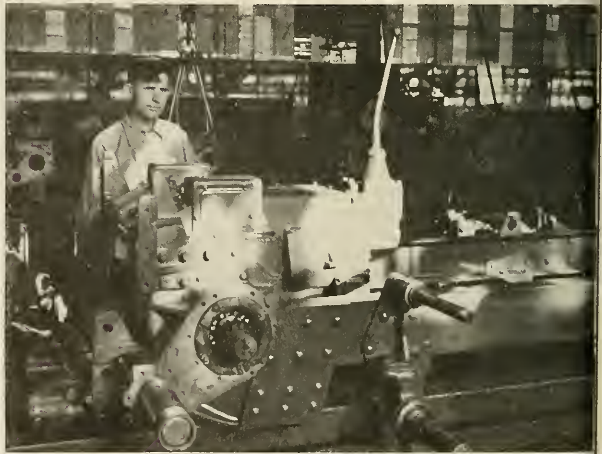


cept the time-honored one of simply referring everything that is being done today to past historical events?

Assuming that the anthropologist trained to study primitive man by direct observation could learn something about modern Russians if he looked, he can't go and look. He can't stand beside agricultural workers as they donate, under compulsion, a piece of "voluntary" Sunday work to keep the costs down. He can't mingle with a group on a railroad train who are busily exchanging rumors that there will or will not be more bread. What, then, has a natural history museum been doing in the field of Soviet culture?

Anthropologists bring to such an activity their own body of theory and their own tools. They assume that all human beings—of all races and languages, with and without writing—are the same order of creature with the same range of capacities. Regardless of the descriptive tags that people have invented in thinking about themselves or others, as when they speak of "Slavic souls," "Western genius for organization," or "Oriental mysticism"—anthropologists place man in nature among all living creatures and see him as a special kind of living creature born with definite potentialities and vulnerabilities. And anthropologists view all the differences—in language, in ability to think scientifically, in food habits and philosophy—as differences learned after birth. If a hundred Russian babies chosen at random were exchanged for a hundred American babies chosen at random, we assume that the Soviet-born babies would grow up to be indistinguishable from other children reared in the United States, and the American-born babies would be indistinguishable from other Soviet-reared children. So, while the differences in what Soviet parents teach *their* children and what American parents teach *their* children are to be explained by their disparate pasts, the question the anthropologist asks is: Given the context, given Marxism-Leninism-Stalinism, and given our American doctrines of the Rights of Man, how does a human infant, equally capable of becoming a believer in American democracy or in Soviet communism, learn to become one or the other? And just because anthropologists are trained in natural-history methods, they are not content with the kind of answer that says children reared in America become Americans by "imitation," by "habit." That's the sort of loose explanation once used to explain that a male bird knew that another bird was a female by "instinct." The Department of Animal Behavior at this Museum has spent two decades showing that the "instinctive" male response to a female can be analyzed into responses to very small details of clues given by color, movement, relative size, or degree of mobility, and even these clues have to be at least partly learned.

The idea that people grow up to be like the other members of their society because of vague concepts called "history" and "habit" is an explanation just as unsatisfactory and out-of-date as the idea that a male frog recognizes a female simply by "instinct." Anthropologists by using careful natural-history methods in simple societies have learned to study the ways in which human babies learn to be "Eskimos" or "Samoans"—just what the mother does, just how the infant responds, and just how the infant's response stimulates the mother to the next "traditional" piece of behavior. From studies of such things as the role played by the ways a child is carried and the way he is hushed to sleep or left to cry it out, we have built a theory of cultural learning. So we bring to the study of the unobservable new Soviet character a theory (one that has stood a good deal of testing) of the psychic unity of mankind and a theory of cultural learning.

Anthropologists, furthermore, are accustomed to relate each bit of the behavior of the peoples they study to all the rest of their behavior. When, as is the case with Soviet material, we have only very partial information (we have, for example, films the Soviet Government has permitted to be made, but we have no information about how the people laugh or weep when they see them), anthropologists have methods for making estimates of behavior about which we have no information from direct observation. Although such estimates are less accurate than the results of an on-the-spot study, they are a great deal better than nothing at all. They might be compared with the estimates of paleontologists who construct a complete model of an extinct animal when they actually have only part of its skeleton. They can do this because they know something about the way whole animals are put together, what spinal columns are like, how jaw bones fit. In the same way, the anthropologist who has studied small primitive societies knows something about how whole cultures fit together, and his knowledge can be used to interpret the kind of partial material we get from the Soviet Union.

With this set of anthropological theories and skills, we went about constructing a model of Soviet character today. First we built up teams of social scientists—specialists in Russian history, Russian literature, Communist Party history, and so on—who were to work with anthropologists and psychologists who knew something about cultural behavior and individual psychology. Then we took the following steps: First, we constructed a model of the national character before the Revolution—of the people of the area known as Great Russia. We did this by using interviews with old Russian *émigrés* and analyzing written sources, searching behind them for the living human beings who had written and believed them. Second, we constructed a model of the Russian intelligentsia, especially of the Bolsheviks, the group within the old intelligentsia who came into power at the time of the revolution. Third, we studied the official utterances of the Soviet regime—its theories of child care, pedagogy, and industrial organization; the films it permitted to be

Julian Bryan photo, from Acme

▲ A VIEW in a state nursery maintained for the children of mothers who work in factories. The children are kept in apertures in a special table

Press photo agency, J. Ryumkin

▲ A FACTORY WORKER nursing her baby in a public nursery, Moscow, March, 1947. In the Soviet Union, women are expected to work outside the home. Care for the welfare of mothers and children means giving women time off to nurse their children. The child here is not freed while being fed

▼ SWADDLED new-born babies in a Soviet maternity home in Tashkent

Sovfoto

made and the novels it permitted to be published; the new folklore about Lenin and Stalin that it built up synthetically in the old poetic forms. When we had these three sets of materials—what the old Russians were like, what the new group who wished to change them was like, and what methods the new ruling group was using to produce the changes—we asked questions: What will happen to children of people like the old Great Russians if they are exposed to the conditions the Bolshevik leadership has set up? Judging by our knowledge of human cultures and individual human behavior, what can we expect?

When the Bolshevik leadership took power, they had control of a sort over a vast country, mainly inhabited by peasants, who had for centuries been subjected to the demands of an arbitrary and alien authority, which they had learned to circumvent and sabotage in a thousand adroit ways. The Russians were a people subject to extreme swings of mood and bound in close emotional dependence on a large group of people rather than tied closely to individual parents. They were a people with extraordinarily little interest in material things. They displayed an unusual tolerance of the evil in others, feeling that each human being had a right to live and to search for truth and that all human beings shared in the sins of others, but also that each human being was human and was to be treated accordingly. Characteristically, when political exiles were sent away, chained, to Siberia, crowds turned out to give them gifts of food and to grieve for their sorrows. When prisoners escaped, the people hid them, saying, "Why do they need this one when another, or two others, will do as well." They had great endurance in carrying rather than lifting; once a load was laid on his shoulders, a man could carry it a long way. They had great zest for life, and when there was an opportunity for dancing or drinking or feasting, they went about it with a vigor that was tiring even to watch if you came from another national background and had a lesser store of optimism. Although people were very poor, still it was believed that somehow, somewhere, there was enough for all. Speech and thought were studded with rapid kaleidoscopic visual images, and what was thought was felt to be as real as what was said or done. What was done might be undone—a friend could become an enemy and again a friend, or be both simultaneously—the borders between the thought and the deed, the loved and the hated, were rapidly shifting and uncertain. Hatred in particular was difficult to keep focused on a given individual, and anger could be dissolved by love into pity—the emotion that was valued above all others among those educated Russians who discussed such matters articulately. Time was unimportant; appointments could be kept hours late, meals waited for those who returned, what happened today was no earnest of what would happen tomorrow, but a new token of faith or friendship would be exacted.

When we studied how infants born in Russia were reared so that they represented this Great Russian character, instead of taking on some quite different character, certain aspects of their child rearing practices were particularly illuminating. The Russian baby was swaddled, as were most of the infants of Eastern peoples and as Western European infants used to be, but they were swaddled tighter and longer than were, for example, their neighbors, the Poles. A Russian swaddled baby was as stiff as "a sawed-off segment of a telegraph pole"—as one American historian of Russia described it to me recently—and they were swaddled day and night, only being undone to be fed,

Sovfoto

▲ SOVIET BOY before and after admission to the Kharkov Suvorov School in Chuguyevo, where he will be trained to be an officer in the Red Army. His clothes show that he comes from the upper 10 per cent of the population

Sovfoto

▲ BREAKFAST in the Suvorov School, where Soviet boys are trained to become army officers

➤ A BORDER GUARD stands as proud and straight as the wooden marker guarding the Soviet frontier

Jack Benton, from Frederic Lewis

▲ **Russian peasants** with crude hand tools of the kind used for centuries

Acme photo

▲ **This** is described as a "triumphal procession of laden carts," characteristic of the first delivery of crops to the government from a collective farm

Copyrighted photograph by John Strohm, from Acme

◀ **A former Red Army captain,** now serving as agricultural technician on the Mironovka Seed Selection Station in the Ukraine, has been photographed in uniform beside a knocked-out tank in a waving field of wheat. The close relationship between mechanized industry and successful warfare is stressed in this photographic choice

bathed, or changed. Day and night presented little contrast. Hands that were tightly bound inside the swaddling bands could not explore. During the first year of life the swaddled child, cared for by an old woman or a child nurse, was carried about, experiencing but never touching the teeming, vivid, highly charged world around it, being in it, but not of it. The Russian proverb says: "The eye sees but the tooth can not reach." This early period seems to have left a stronger impression on Russian character that the same period of learning does for members of many other societies in which the parents are more preoccupied with teaching skills appropriate to later stages of development, as Americans, for example, are preoccupied with teaching self-control, cleanliness, and autonomy.

So we find in traditional Russian character elaborated forms of these very early learnings. There is a tendency to confuse thought and action, a capacity for impersonal anger as at the constriction of the swaddling bands, but also for great warmth and outgoingness to individual human beings, a tendency to feel that all behavior is reversible —as the child who destroys his mother in his imagination can reconstruct her again in an instant. There is a low interest in reality in the sense that Americans think of the real world of measurable, ponderable objects, and a high interest in abstractions like truth or mathematics. There was too a concentration on the way one felt and less interest in the other person, although a high dependence upon being one of a group or a mass. (This does not mean that swaddling infants in a different culture would produce any of these effects. We are discussing here how Russians, with their traditional attitudes toward human beings as strong, full-passioned creatures needing external control, communicated with their young children so that their young children grew up to share these values.)

The Bolshevik leadership revolted against this vague, diffuse, mystical attitude, against hope without substance and dreams without effort. They wanted to forge a society that would use all the methods and tools of modern Western science, in which disciplined, purposeful, forceful, externally oriented people would forge forward relentlessly, tirelessly, toward a goal. Concretely, they wanted a people who would get to work on time, who would subject themselves to the one-way discipline of the machine, who would come to think in minutes instead of days. In place of the vague, diffuse family and village relationships that allowed the growing child to choose among half-a-dozen contradictory adult models of possible behavior, they wanted to substitute single consistent models, so that parents, teachers, and youth leaders would all present the same undeviating behavior lesson. In place of the old permissiveness for a child to live up to its strength and rest content, the Bolshevik educator wishes to substitute a character structure in which each achievement induces an accompanying discontent, forcing the individual on to greater effort. Where the old Russian had been tolerant, the new Soviet man must be intolerant of himself and of others. Where the old Russian had loved and hated the same person, fluctuatingly, concurrently, the new Soviet man must learn to focus hate continuously on the enemy, and love—absolute, undeviating, complete—on the Soviet State. Under the old system children had been ignored and subdued after they had learned to walk, with very little attention having been given to them. The sharp learnings of the first year remained the mold into which later impressions were fitted. The new child-rearing stressed early habit training, starting as early as three months, by exercise, discipline, activity, and emphasis on testing reality by action and manipulation. Instead of the old vagueness about the difference between thought and action, there was to be no thought that was not welded into action, no image in the mind that was not a counterpart of external reality.

But most of the Bolshevik leaders were, after all, Great Russians themselves. Their emphasis on action, on focus, on control was not the same as American emphasis on action, on purposefulness, on autonomy. American children learn to value autonomy and manipulative skill because they have always been rewarded for attaining it. Mothers and fathers who are not sure how strong and assertive their children really are urge and reward activity, planning, and autonomy. But the Bolshevik leader, in valuing these same goals, was reacting against a society in which these goals were *not* valued. He came to glorify this reaction, to insist that character could only be formed by "swimming against the stream." He fought down in others and in himself any temptation to express either the old patient endurance of life (which came to be identified politically with Right deviationism), or any wild, enthusiastic, unthinking pursuit of romantic dreams (which came to be identified as Left deviationism). Instead, all behavior must be exactly focused, not by some compromise between different positions, but by being exactly right, in a position in comparison with which all other positions are out of focus. (Politically this position is called the "Party Line," which may change abruptly, may appear contradictory, but which at the moment when it is promulgated by a leadership whose claim to leadership is just their ability to perceive the exactly correct line of conduct, to "hear the grass growing under the ground," is conceived as the correct and only possible course of action.)

This focus must be maintained by absolute control, by ceaseless vigilance over the self, by the new kind of consciousness that was being developed. (Politically, the counterpart of this untiring watchfulness is the omniscience of Stalin, who is represented in Soviet poetry as standing on the Kremlin with a spyglass in his hand, seeing all that goes on in the land, and by an omnipresent secret police.) The control over the self must be matched with control over others, over their every act, their every thought, their every impulse. If the external world did not match the expectation of the leadership, it must be made to do so. Novelists who represented life in the Soviet Union as contrary to what life should be in a communist state were condemned as political traitors. Individuals who were believed to feel hostile toward the regime were given trials that were essentially dramatizations of crimes they might have committed, had they followed their feelings, for which they could then be sentenced to ten years' hard labor.

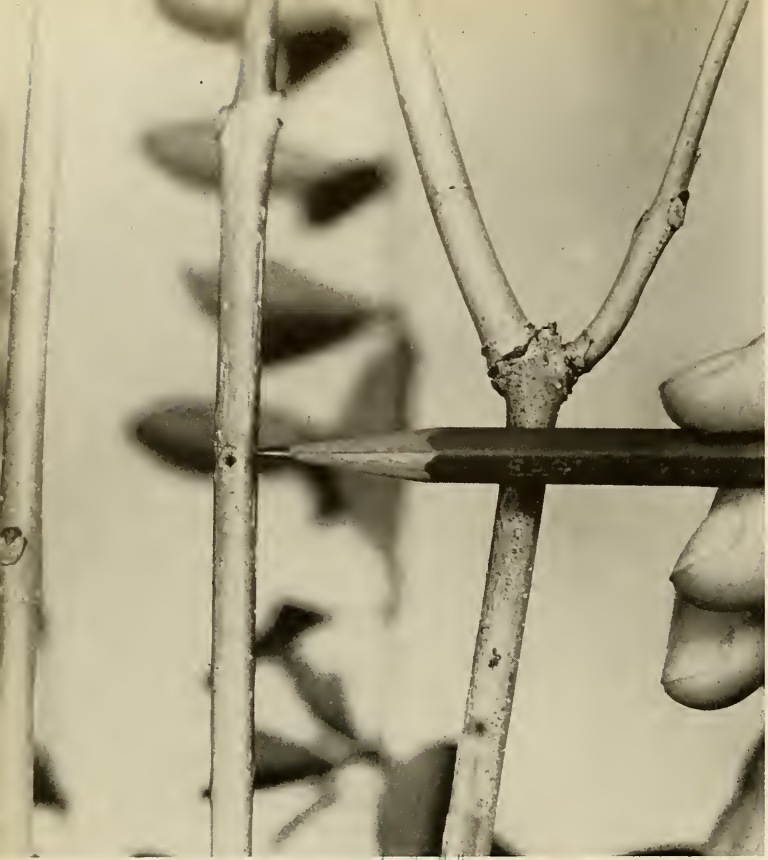
But the Bolshevik leadership, although some of its aims were new, still had a great deal of the old Great Russian character structure. As they fought against their own traditional character, the defenses that they erected partook of the characteristics against which they fought. As they tried to substitute reality for the old, idle dreaming omnipotence of thought, a new kind of omnipotence of thought that made them believe they could manipulate reality in any way they liked took its place. As the old Russian atoned in his mind for a

Continued on page 336

Training—physical and ideological: *At left:* Two thousand school children taking part in a sports festival at the Stadium. *At right:* A scene at an art exhibit in Odessa, showing pupils and their teacher. The piece of sculpture portrays a working man and his wife and two children being evicted from their home in a capitalistic country

Ewing Galloway photo

Acme photo



▲ THE ENTRANCE HOLE to the nest is about the size of the lead in a lead pencil

an ANT *that* USES ITS HEAD

This living door—the head o

By ROSS E. HUTCHINS
All phtographs by the author

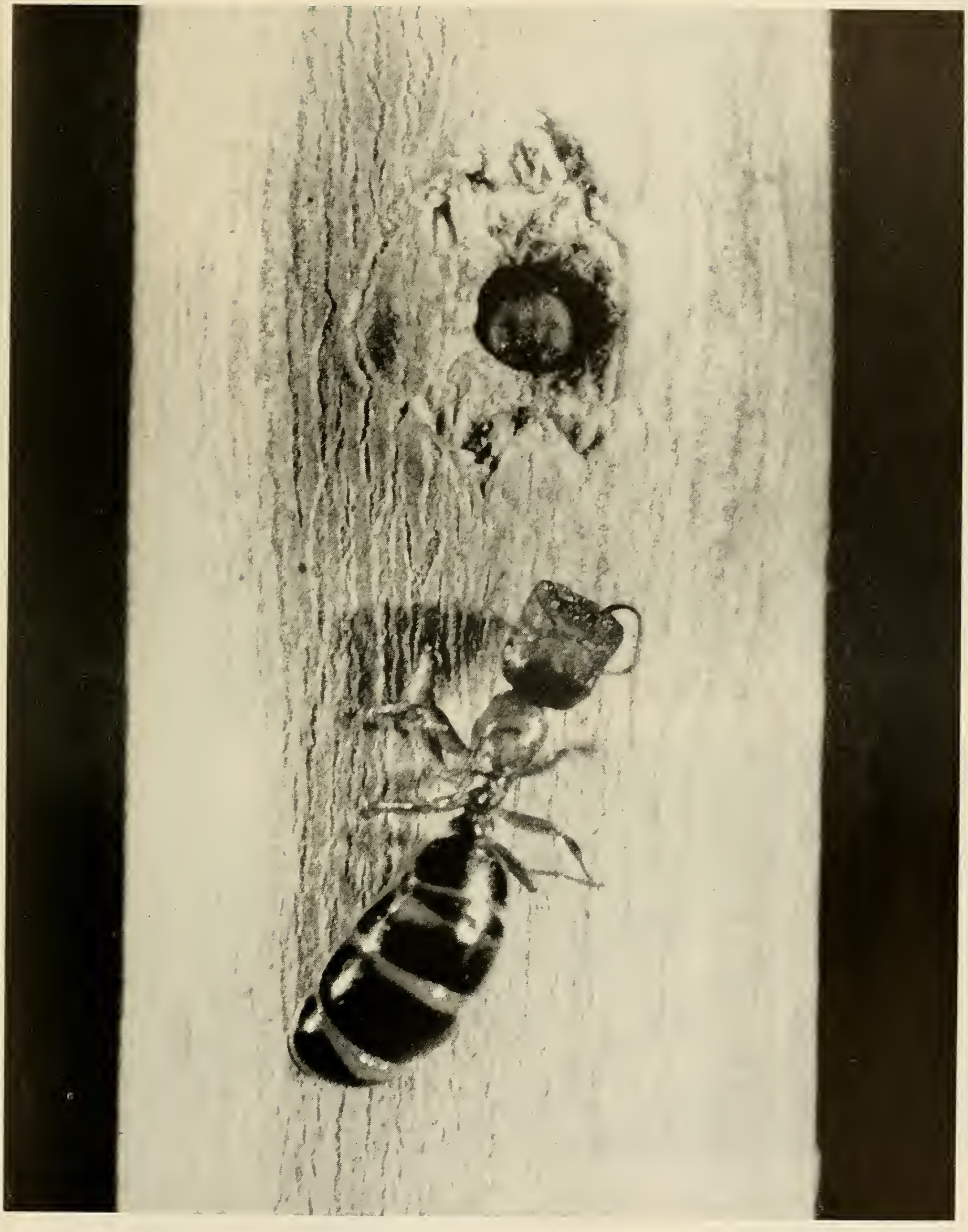
PERHAPS if the human race survives the vicissitudes of the Atomic Age and of other ages whose hazards are yet unguessed, we will have developed, in a million years or so, individuals in our society who are especially adapted to do certain tasks. A wild thought, perhaps, with a creature so independent as man, but that, at least, is how many of the social insects have evolved.

Many ants and termites have various castes, whose members differ in size and often in bodily form and specific structures. These differences enable them to carry out different functions in their colonies, and sometimes the differences are rather extreme. Certain individuals in many ant colonies have large jaws, for example, and their specific function is the defense of the colony. The worker caste has become so highly specialized in some cases, as for instance in certain Amazon ants, that they cannot even feed themselves, being entirely dependent upon their slave ants.

There are numerous examples of such specialization among insects, but one of the most interesting cases is that of the Colobopsis ants, first cousins to our common Carpenter ants.

Queen Colobopsis looks pretty much like any other ant. After her nuptial flight she runs about, to and fro on ground and bushes, until she happens to climb upon the right kind of shoot, usually white ash. She gnaws a small hole in the plant and penetrates the soft pith within. She excavates downward a short distance and then deposits several white eggs. This is her first step in establishing a new colony. Once in her cell, the queen never leaves it.

Time passes, and the eggs hatch into tiny white grubs. She busily feeds these, frequently handles and licks them, and stands over them lobopsis ant—opens only when a member of the colony gives the "password"

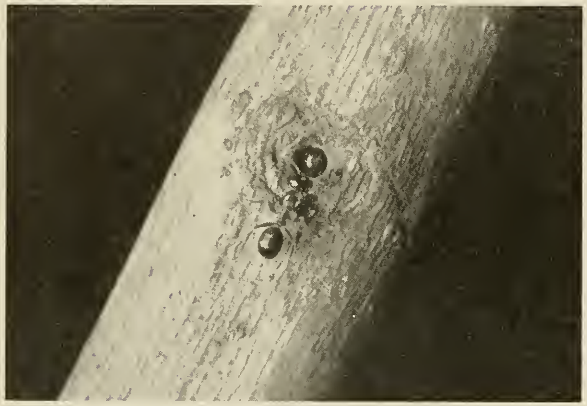


▲ A RETURNING GUARD, approaching the entrance. Note the pluglike head of another guard in the entrance hole almost constantly. At the end of several weeks, the young ants have developed into pupae, and they no longer must be fed. This is their resting stage. Soon, however, these pupae transform into adult ants.

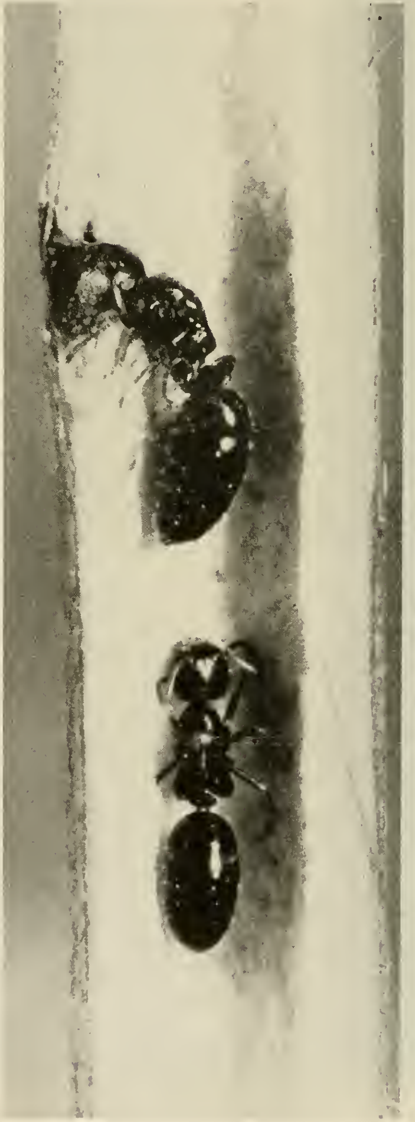
Now, if you will examine these individuals closely, you will find that they are not all the same. Some of them look pretty much like the queen, although smaller; but others are larger in size and have strange, pluglike heads. These individuals belong to the guard caste, and one of them is almost always on duty at the entrance to the nest, closing the opening with its stopper-shaped head.

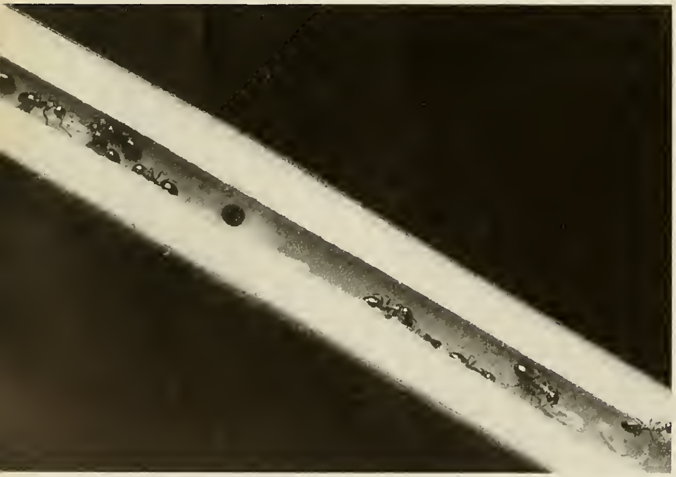
When a worker of the colony comes up the tube toward the exit, ready to leave, the guard backs up and lets it out. When the forager returns, mounts the twig, and touches the portal, the guard pulls away, in response to some antlike equivalent of a password. Rather than any form of symbolic "Open Sesame," in all probability this is simply a few gentle taps of the forager's antennae, which serve to rouse the portal to action if accompanied by the familiar colony odor.

Thus, the especially adapted head of the guard forms a living door which closes the nest entrance to all except members of the colony.



▲ Here the returning worker is actually photographed in the act of tapping on the guard's head—the "open sesame" that will lead to admittance





▲ Comparatively normal activity goes on in the colony when the twig is split open. Here the ants care for their young

➤ This posed picture of a split twig shows how the guard plugs the entrance with its head

SOME LIKE IT HOT

Courtesy Standard Oil Company (N. J.), Webb photo

▲WORKERS picking Tabasco peppers at Avery Island, Louisiana

The peppers that soothe your palate
have burned their names into the pages
of history and have been used
both as medicine and poison gas

By CHARLES B. HEISER, JR.
Botany Department, Indiana University

IN 1493, Peter Martyr wrote that Columbus had brought home with him "peppers more pungent than that from the Caucasus." Since that time the American red and green peppers have become widely known as a spice and as a salad plant, but the uses of peppers have been far more numerous than this. In the past—and even in modern times—peppers have been used in medicine. At one time they were used for dropsy, colic, ague, toothache, black vomit, and gout. At present, they furnish an ingredient in preparations to relieve throat irritations and also in an application to stop children from thumb sucking and nail biting. A teaspoonful of cayenne pepper in water is reportedly a remedy that really works for seasickness, although some people might prefer the malady to the cure.

Some varieties of red pepper are so hot as to have produced a burn requiring medical attention. According to several sixteenth-century observers, the smoke from burning peppers was used as a poison gas by

Ewing Galloway photo

◀ MOST of our peppers are grown in California and Florida. Here the harvesting is in progress at Sanford, Florida

▼ THE PUNGENT PODS that the American Indian gave the world have become a ten-million dollar crop in this country. The familiar green peppers are esteemed in salads and stews. Many different varieties are grown, two of which are seen here

Jack Manning photo from Black Star

South American Indians in warfare with the Spanish explorers. This is not difficult to believe, for Philip Miller, in his *Gardener's Dictionary* of 1768, wrote: "If the ripe pods of *Capsicum* [the pepper] are thrown into the fire, they will raise strong and noisome vapours, which occasion vehement sneezing and coughing and often vomiting, in those who are near the place, or in the room where they are burnt. Some persons have mixed the powder of the pods with snuff, to give to others for diversion; but where it is in quantity, there may be danger in using it, for it will occasion such violent fits of sneezing, as to break the blood-vessels of the head, as I have observed in some to whom it has been given."

Another story from the West Indies attesting to the pungency of some of the peppers has not been verified but is worth repeating. The natives there, it has been reported, test their pepper sauces by pouring a drop on the tablecloth. If the sauce doesn't eat a hole in the tablecloth, it is put aside as being too mild.

Cayenne pepper, red pepper, chili powder, and paprika are all prepared from the dried ripe pods of pepper. The first three are all definitely hot, ranging from a rather pleasant sensation to a fiery burn approaching the hinges of Hades, and are prepared by grinding the whole pod, seeds and all. Paprika is a milder spice, and in the preparation of the better-grade paprikas the seeds are first removed so as not to detract from the color. The best paprika comes from Hungary and is used mainly to add color to food. Professor Albert von Szent-Györgyi of Hungary won the Nobel Prize in 1937 for his discovery that paprika is rich in Vitamin C.

Chili con carne, or "pepper with meat," is a well-known Spanish-American dish which has been widely adopted in this country, although in the United States much less pepper is used in its preparation than in Mexico. Another Mexican pepper sauce, *mole,* contains three varieties of pepper, all hot, plus chocolate and eleven other ingredients. According to its enthusiastic advocates, its use can soothe the troubles of the world.

Among the pepper sauces, perhaps the best known in this country is Tabasco, named after a hot pepper that originally came from the state of Tabasco, Mexico. The history of the commercial development of this sauce dates from the middle of the last century. Following the Mexican War of 1846-48, seeds of an especially fine pepper were brought back from Mexico by a soldier and grown in Louisiana by Judge Avery and Mr. McIlhenny, a banker. After the Civil War, these

Charles M. Rick photo

▲ A branch of the South American pepper, "rocoto" (*Capsicum pubescens*). The flowers of this species are purple, whereas those in our common garden peppers are white

▼ **Peppers brighten the garden.** This is a variety of the common garden pepper (*Capsicum annuum*), in which the pods are borne in clusters. The red pods are especially decorative. But don't bite into one of them. Even touching the eyes after handling the pods can cause a burning sensation that will last several minutes

Charles D. Heiser, Jr., photo

gentlemen found themselves impoverished, and they experimented with the making of condiments and seasoning. One of the sauces made with the Tabasco pepper was especially flavorable, and friends persuaded Mr. McIlhenny to market the new sauce. Today its use is widespread. The pungent, highly aromatic qualities of this sauce are brought out by a special process. Most table sauces are cooked before bottling, but the Tabasco peppers are macerated after picking and packed in oaken cases without cooking. The macerated peppers are aged for three years, and the cured mash is then mixed with vinegar before bottling. Tabasco sauce is used to bring out the flavor of a great number of foods, and one person has even reported that it is good on ice cream.

Today in this country the peppers —both hot and sweet—are a ten-million-dollar crop. They are widely grown, the greatest areas of production being centered in California and Florida. The sweet peppers or bell peppers are widely used in salads and for stuffing with meat. The peppers contain vitamin A as well as C, so that they constitute a nutritious as well as a tasty dish. The ease with which peppers can be grown and their relative freedom from insect and fungus diseases make them an ideal plant for the home gardener. The sweet varieties, California Wonder and World Beater, are particularly widely grown. For some reason, the large sweet varieties are referred to as "mangoes" in the Midwest, although the name "mango" is more properly applied to the fruit of a tropical Asiatic tree *(Mangifera indica).*

Another variety of sweet pepper, pimiento, is used in olive-stuffing and cheese. Here, too, the common name is somewhat ambiguous, for the term pimiento is also applied to allspice, which is derived from the fruits of a Central American tree *(Pimenta officinalis).* The confusion resulting from the use of the same common names for completely different plants is one of the many good reasons for scientific plant names, which can be used for one and only one plant. Another pepper often grown by the home gardener is the Banana Pepper or Hungarian Wax Pepper. This is a somewhat pungent variety, whose fruit changes from greenish-yellow to yellow to red. It is eaten in the yellow stage, and the color plus the shape has led to the name Banana Pepper. Some varieties of peppers are highly ornamental because of the beautiful and various colors of the fruit. These are occasionally seen in flower gardens and greenhouses. As a border plant for the flower garden, the variety Floral Gem and some of the other Celestial Peppers have few equals.

The red and green or chili peppers that we have been discussing all belong to a single genus of plants known botanically as *Capsicum,* and the active ingredient producing the pungency is a volatile alkaloid known as capsaicin. The peppers are closely related to the tomato and potato. Like these plants, peppers were introduced into Europe from America, and for some reason they were much more readily adopted as a food plant by the Europeans than either of their more important relatives. The name pepper itself—like mango and pimiento —is somewhat misapplied when it is used for *Capsicum.* The true peppers, the black and white peppers, come from a totally different plant, *Piper nigrum,* which is native to the oriental tropics. However, the use of the name "pepper" for American plants is not difficult to understand. The early Spanish explorers were interested in finding the spices of the Far East, and the red-hot pungency of the pods of the American plants led them to believe that they had found a new sort of pepper.

The use of the scientific name, *Capsicum,* for these plants is somewhat more difficult to understand. It has been suggested that this name comes from *capsa,* Latin for "box," because of the supposed boxlike shape of the pods of some of the peppers, or possibly from the Greek word *kaptō* meaning "to bite," alluding to the hot, pungent properties of these plants.

Over 100 varieties of peppers are known in North America alone, the

Courtesy Information Office, Republic of Indonesia

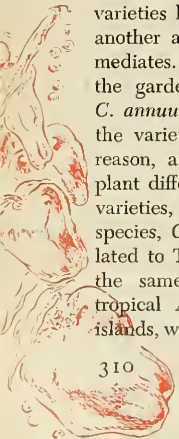
▲ UNKNOWN to the American Indians was black pepper (*Piper nigrum*), widely cultivated in the Far East. At left are the ripe fruits, or "peppercorns," that are the source of the black pepper of commerce. At right, fruits with the outer coats removed, used to prepare white pepper

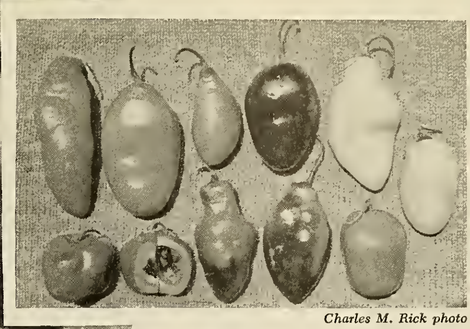
majority of which belong to the species *Capsicum annuum*. These varieties differ chiefly in the shape and size of the pods. Some of the hottest varieties are no larger than cherries, and some of the mildest varieties are as large as a tomato. At one time most of these varieties were called distinct species, but it has since been learned that the varieties hybridize freely with one another and produce fertile intermediates. However, so far none of the garden peppers belonging to *C. annuum* can cross readily with the variety Tabasco, and for this reason, and because the Tabasco plant differs slightly from all other varieties, it is placed in a separate species, *C. frutescens*. Peppers related to Tabasco and belonging to the same species are found in tropical America and the Pacific islands, where they apparently grow wild. How these plants got to the Pacific islands poses an intriguing problem. Some botanists maintain that some American plants were carried to the islands by voyagers in pre-Colombian times, whereas others just as stoutly hold to the idea that they were introduced into the Pacific by the Spanish. As there is some evidence in favor of a prehistoric transfer of at least one plant, the sweet potato, the distribution of others like the pepper warrant critical study.

How many other species of peppers there are is not known with certainty, but there are at least two other cultivated species—*C. pubescens* and *C. pendulum*—in Central and South America, which have long been grown by the Indians; and several wild species are also placed in this genus of plants. The wild ancestor of the cultivated species is not definitely known.

That the chili or *Capsicum* peppers are American in origin has, however, been established beyond much doubt by the presence of wild species in this hemisphere and by the fact that the peppers have been cultivated by the natives of America for a long period of time. Remains of pepper pods and seeds have been found in Peruvian graves that date from more than 2000 years ago. The Indians of the Americas probably found the peppers a valuable supplement to their farinaceous diet of corn, beans, and potatoes. They are still extensively used by the Indians of Central and South America—the hotter the better. Not only are peppers used in cooking, but the children are reported to eat the small pungent varieties the way we would eat peanuts.

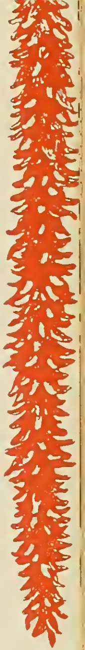
How the Indians brought the

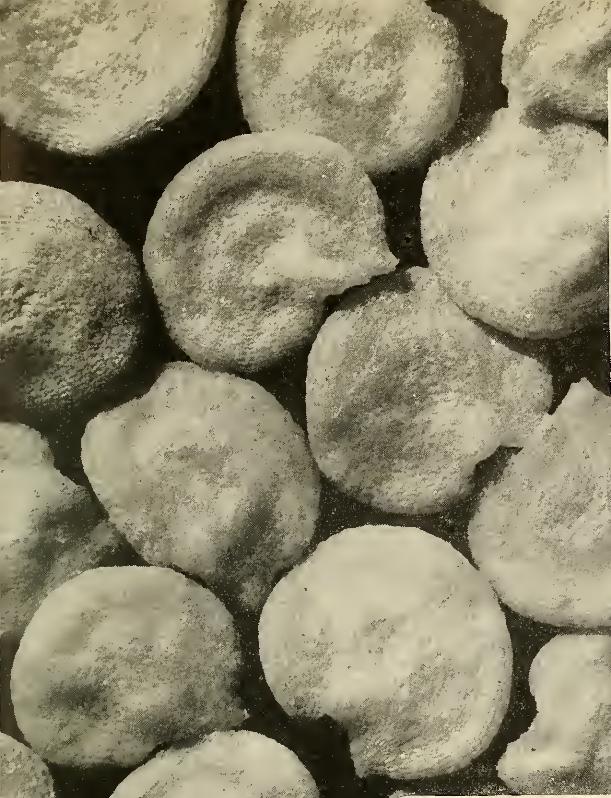




Charles M. Rick photo

▲ SOME IDEA of the great variation in peppers can be seen in the pods of the South American pepper, rocoto (*Capsicum pubescens*). The fruits also vary in color—red, orange, yellow, and brown





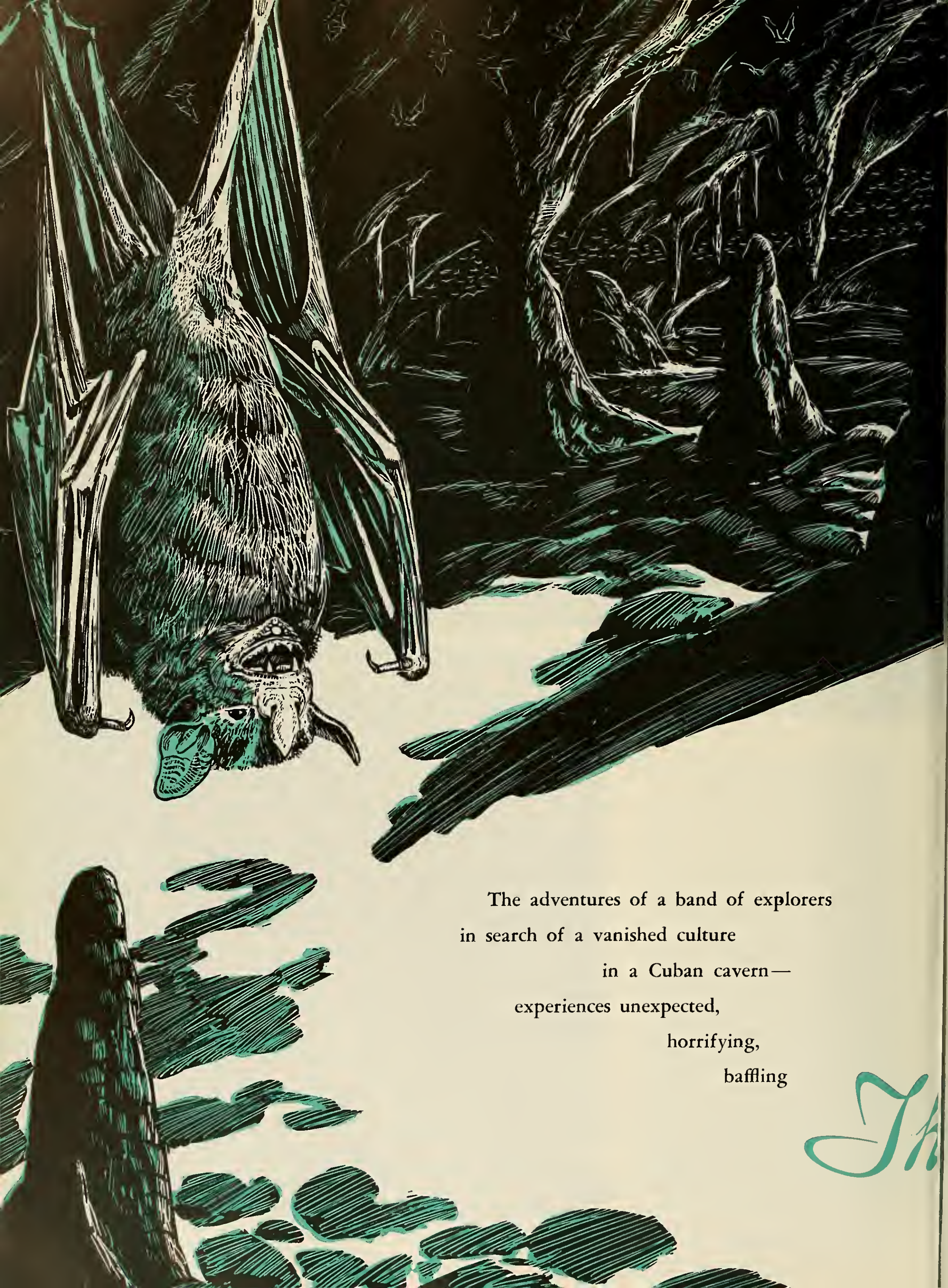
◀ SEEDS of a pepper, highly enlarged

William D. Barkley photo

▼ CHILI PEPPERS drying in the sun: a familiar ornament of the patio in Mexico and our own Southwest

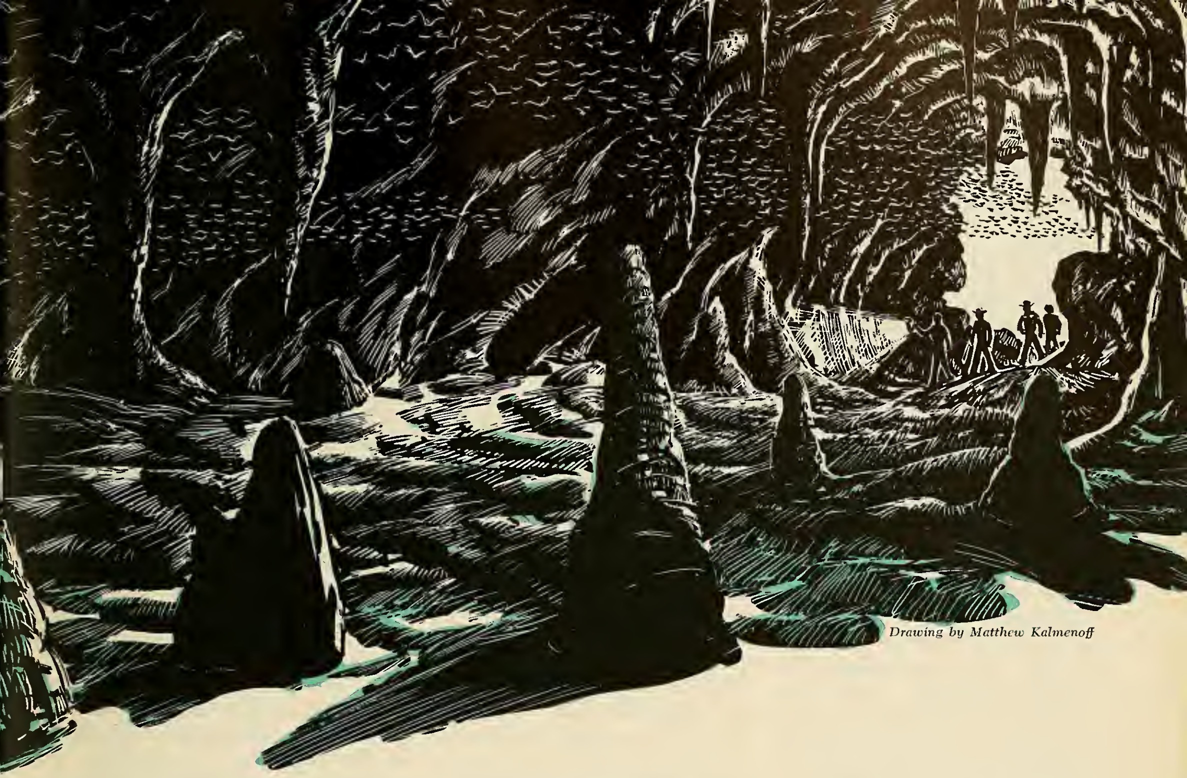
George W. Thompson photo

peppers under domestication is, no doubt, an interesting story, but at present we do not even know where or when this occurred. We can narrow it down to Central or South America, and it is not improbable, of course, that different species were brought into cultivation in both areas. The problems involved in tracing the origins and diffusions of our cultivated plants are exceedingly difficult. They provide fascinating research, however, and are of great importance not only to the botanist but to the anthropologist, who can use the information gained from the study of cultivated plants in piecing together the early history of man. Studies on the peppers, now under way by Dr. Paul Smith of the University of California, may eventually help fit together some of the pieces of this complicated puzzle.



The adventures of a band of explorers
in search of a vanished culture
in a Cuban cavern—
experiences unexpected,
horrifying,
baffling

Th



Drawing by Matthew Kalmenoff

Idol of the Cave

By M. R. Harrington

Curator, Southwest Museum,
Los Angeles, California

"PEOPLE tell me, señor, that you have discovered a cave at La Patana in which you found hairy spiders knee-deep. Is that a fact?"

I had to inform the gentleman that he should not trust back-country gossip, especially the brand current about Cape Maisí. The term he used, *arañas peludas,* strictly interpreted "spiders hairy," in Cuba refers to tarantulas. We did not find tarantulas knee-deep in the cave he had in mind, but what we did encounter was almost as extraordinary and unexpected.

My first intimation that such a cave existed came some time before, while my archaeological expedition, sent out by the Museum of the American Indian, Heye Foundation, was quartered at the little village of Jauco on the south coast of Cuba, some distance west of Maisí. Well I remember the evening when a gaunt young Cuban, his once-white suit smeared with the red clay of the hills, arrived from La Patana, bearing a mysterious bundle swathed in cotton sheeting.

Opened, it disclosed a number of little human and animal figures made of pottery, which seemed to be handles broken from bowls, and several polished-stone hatchet blades that were very well made. Finally, there was a beautifully finished wooden platter with carved decoration and a grotesque head on one end for a handle. It was of ancient Indian make but unlike anything I had ever seen. We were amazed, because our own digging thus far in Cuba had produced only very crude implements of shell and stone.

"From a cave near my home," the young man explained. I knew the platter must have come from a cave, and a very dry one at that, or it never could have survived the centuries. "My family, the Mosqueras, own the place."

"There are other caves at La Patana," he went on, "some very dark and very large, that we fear to enter. Strange sounds are heard within them, and the air has a sickening smell. In one, they say, there is a *zemí*, an idol of stone worshipped by the Indians long ago; and the grandfathers tell us that the monster serpent of Maisí, *la Culebra Serpiente,* dwells somewhere within them."

I had heard yarns of the "Snake Serpent," and I might have thought they contained a grain of truth if the storytellers had not always insisted that the creature "crows like a rooster." That was too much to swallow. The story of the idol might be a fairy tale, too; but if it really existed—and we could find it—it would be a prize for the Museum. At any rate, the caves of La Patana should be explored.

Our visitor explained that the name La Patana referred to a wooded terrace—he called it a mesa—on the south flank of the great limestone plateau that forms the eastern tip of Cuba. There were five or six such terraces, he said, forming giant steps from the flat summit down to the sea. La Patana, named from the Patana cactus, lay about halfway down.

Finally, our work at Jauco was finished. By this time we had discovered why the first specimens our excavations uncovered were so much cruder than the fine articles from La Patana: they had been made by a different people—an earlier, more primitive tribe, who had preceded the more advanced Taino Indians found by Columbus in eastern Cuba.

The early people, whom we called "Ciboney," apparently raised no crops but lived entirely on the natural products of the forest and the ocean—mainly the former, to judge by the great number of land-snail shells and land-crab claws they left behind in their ash dumps. In place of pottery, they made bowls and dippers of large conch shells with the insides removed, and conch shell instead of stone was their material for hatchet blades and gouges. How long they lived in Cuba we have no way of telling; but the bones of a large extinct animal, the ground sloth (*Megalocnus*), are sometimes found in Ciboney cave deposits, and this suggests a long time.

After them came the Tainos, an agricultural people, growers especially of *yuca,* or cassava, and of corn. In fact, our word "maize," applied to Indian corn, comes from the Taino language. They were skilled potters and loved to decorate their work with little figures of men and animals, modeled in the round. Their ax heads were of stone, often beautifully shaped and highly polished. Their wood carving was excellent, and they were skilled in making ornaments and little charm statuettes in shell, bone, and stone. The things brought to us from La Patana were undoubtedly Taino products.

So it was with high expectations that we moved our headquarters eastward to the Finca Sitges, an extensive coffee and banana plantation on top of the plateau, owned by the hospitable Don Antonio Rey. By this time our party had received a welcome addition—a representative of the Cuban Government, Dr. Victor J. Rodriguez, who was a zoologist from the University of Havana. Of course, La Patana was one of our first projects.

Following a narrow trail and burdened with packs of food, hammocks, and blankets, we climbed down over limestone cliffs and crossed stretches of orchid-hung tropical forest. Finally, once more descending, we sighted the palm-thatched roofs, beehives, and broad-leaved plantain trees that told of human habitation. In a few minutes we were talking with the elder Mosquera, father of the young man who had visited us. He assured us that we could explore the caves to our heart's content. They used only one, which contained the spring from which they drew their water.

I asked him why they had no trail for saddle or pack animals. I was amazed at his reply: "It is not necessary," he said. "We raise most of our own food here. If we need anything from the store, we trade honey and beeswax for it, and that can be carried easily on foot. If money is needed, the boys go up and work on the *fincas.*"

He detailed one of the "boys"—his son Cecilio—to show us around. Depositing our packs and taking only trowels, camera, carbide lights, and a lantern, we set out.

First he led us along a well-beaten trail to the Cueva del Agua, water supply for the Mosqueras. Passing through the high-arched entrance of the cave, where stalagmites stood looking from a distance like groups of statuary, we soon reached the crystal-clear spring. It lay at the very back yet was still in plain daylight. We searched and searched but found little trace of ancient Indians, except for a few bits of pottery at the very entrance. Then we followed Cecilio to the fateful passageway leading back into the mountain, which we had not noticed before.

"Where it leads I do not know," he said. "We have never dared to follow it. But you have good lights; with you I am not afraid."

With some trepidation we set out. The passage dipped slightly downward, turning to the west. We had just begun to feel a little more at ease, when suddenly it ended—in

▲ **WITHIN THE MOUTH** of Cueva del Agua—a fit setting for the dark adventures the explorers encountered

a great black gulf. We saw this just in time.

We approached the edge cautiously and shone our lights into it. Apparently the chasm had neither end, top, nor bottom. It was Rodriguez who thought of dropping a loose stone into the abyss. After an interval, we heard it ring on the bottom. "It does have a bottom after all," he remarked with a wry grin.

As we stood, a few bats fluttered out of the darkness, wheeled about our heads, and disappeared again. Opening his kit, Rodriguez produced a butterfly net, hoping to catch new species of bats. We turned our lights down so as not to scare the creatures, and it was while Rodriguez was trying to net one that we first noticed the peculiar acrid odor wafting up from the depths.

And then we heard it—a strange, unearthly, roaring sound, which grew louder and louder. We all stepped hastily back from the brink. Gaspar Leiba, one of my helpers, half drew his machete. Bats were forgotten.

We looked at each other in amazement. Now the sound gradually dwindled away until it was nothing but a low murmur. I found my voice first.

"What in heaven's name is *that*? I've explored a lot of caves, some right here in Cuba, but I never heard anything like it." Of course, it couldn't be the *Culebra Serpiente*, or could it? The idea was not pleasant. Also, I am ashamed to say, I thought of the ground sloth, a large extinct animal whose bones we had unearthed in another cavern. Could monster serpents or ground sloths roar?

"I can't understand it," Rodriguez said. "It couldn't be a waterfall deep underground, because the noise is not continuous. It might be surf in a sea cave, only we are too high above the ocean and too far back . . . Listen!" the roar was beginning again.

This time we stood our ground, peering over the brink, but no monsters appeared. All was black darkness as before, but we noticed for the first time a faint glimmer of daylight, distant and far below.

"See that light?" Cecilio asked. "I think that is another entrance, and perhaps I can lead you to it. I went in one day when I was a boy, but something roared at me and I came out flying."

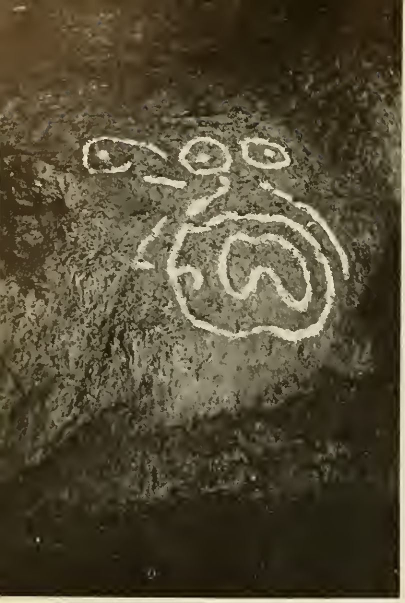
He led us out of the cave, down a cliff, and around a projecting point of the mountain. There, along its base, stretched a great hole, open to the sky and perhaps fifteen feet deep. Fortunately, a large *jaguey* tree grew in the near end, and this we used as a ladder to clamber down. There were two cave mouths running from the hole back into the mountain.

Cecilio picked the easternmost, and in a few minutes we found ourselves in a huge dark chamber. The smell was stronger than before, and again we heard mysterious murmurs and roars. The sounds seemed to come from a passageway blocked with fallen limestone on the west side of the cavern. However, to be sure we were on the right track, I sent Gaspar with a lantern to retrace our steps. Sure enough, after an interval we saw his light emerge high above us on the opposite wall.

After his return we tried to enter the blocked passage but could not get through. Then Cecilio suggested that the other cave mouth might tap the same passage on the other side of the rockfall. He was right.

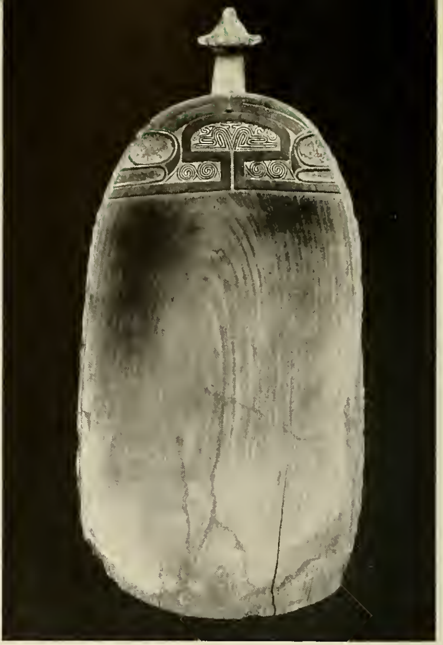
The smell here was much stronger, and the roaring, when it came, louder still. And what a sight lay before us! The floor of the passage, as far as we could see, was carpeted with living, moving cockroaches. Rodriguez, who wore no

THE IDOL in the cave. It stood 50 feet in-
ide, but every morning a shaft of sunlight
truck it full in the face



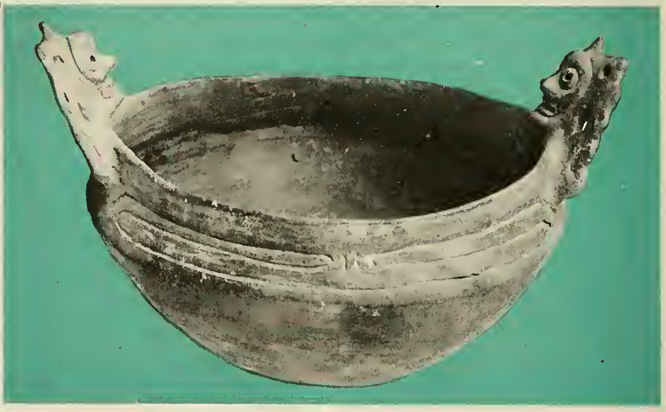
▲ A ROCK CARVING in Zemí Cave

All photographs courtesy of the Museum of the American Indian, Heye Foundation



➤ CARVED WOODEN PLATTER found in one of the caves: a product of the vanished Taino Indians

▼ POTTERY BOWL, with human head handles, made by the Taino Indians near Cape Maisí, Cuba



leggings, kept his legs moving to prevent the repulsive creatures from crawling up his trousers. And every now and then we saw a big shiny centipede winding solemnly along. One, I noticed, had a cockroach in its mouth.

We started walking along the passage, crunching cockroaches at every step. Now the air grew hotter, the roars were louder, the smell was almost overpowering. Bats fluttered overhead. Soon there appeared an added horror; the walls were now decorated with huge, black, spider-like creatures. We later identified them as a species of tailless whip scorpion, with one pair of legs lengthened for use as feelers in the darkness; but at the time, they looked like big black spiders to us.

As we went on, it grew still hotter and more oppressive; the lights flickered, and the kerosene lantern went out. We might have continued, even so, but for one thing. I spied a mound of fighting, struggling cockroaches and kicked them aside to see what they were after. It was a baby bat, already half picked to a skeleton, although the poor creature was still moving a little.

What would happen to *me* if I were overcome by the bad air in that awful place? Already I felt a little dizzy. The same idea must have struck us all at the same moment, for we turned and beat a retreat without a word. I remember we looked back nervously whenever the roar increased, half expecting to see—what?

Climbing back up the cliff, we drew a couple of buckets of water from the spring and washed up. Then, after retrieving our packs, we hung our hammocks for the night from trees near the Cueva del Agua. The Mosqueras had invited us to stay with them, but we politely refused. We were too tired and frustrated and did not even enjoy our supper. It did not improve my own state of mind to realize that we had not seen a trace of ancient Indians since we picked up those bits of pottery. Where was the Idol of Cape Maisí?

As night approached, we noticed a black cloud of bats emerging from the cave mouth, setting forth on their nightly search for food. To check on what might be happening at the last cave we had visited, we made our way down the cliff again. What a spectacle! Here they were pouring out in swarms. It seemed to Rodriguez that there were different species and that the bats emerged in groups, the same kind flying together.

After about an hour, we returned to our hammocks; but the bats were still coming—fluttering black blotches against a fading sky.

Rodriguez came over and sat on the ground beside my hammock. "You know," he said, "I think the heat and the bad air in that cave are due mainly to bats. As you saw this evening, there are an enormous number of them. While they are out hunting food at night the cave should cool off, and maybe they sweep in a little fresh air when they return at dawn. If we try again early in the morning, perhaps we can get somewhere."

It was so agreed. Rising at daybreak, we gulped down our coffee and hardtack. As a matter of precaution, I belted on my .38. I can still picture my little force: Rodriguez, brown-eyed, pale-faced, rather frail of body but determined in spirit, and armed with a collecting pistol; Juan Guache, my *ayudante*, of pure Spanish ancestry, hook-nosed, thin-faced, and as blue-eyed as they come. He carried a machete, as did the other two, who showed plainly their Cuban Indian blood—short but well-built Gaspar Leiba and lanky Cecilio Mosquera. As an extra piece of equipment, Gaspar carried a large canvas bag, to use if we found something worth collecting.

Soon we were again treading the cockroach corridor. Rodriguez was right. The air was distinctly cooler, much more breathable; the lights burned steadily. Even the odor seemed less pungent. But the roaring—that was as loud and frightening as before. We passed the place where we had turned back previously, and pressed on and on. Suddenly an unusually loud roar halted us in our tracks. I confess I grabbed for my gun. All at once the air seemed hotter again, more stifling. The temptation to turn back was strong.

But the sound died away, and we forced ourselves to go on. Soon we were standing on the threshold of another great chamber. We shone our lights about. Wherever we looked, the high vaulted ceiling was covered with clinging bats! Besides these thousands there were hundreds more fluttering about, looking for a place to alight.

"Listen!" Rodriguez whispered.

A murmuring sound was plainly audible. One bat is silent enough, but hundreds of them, in that confined space. . . . There was no doubt about it; the murmur was the sound of their wings, reverberating from the vaulted roof.

"I'm going to try something," he continued. "Watch this!"

"HOLA!" he shouted.

Instantly every bat in the cave took wing; the murmur rose to a roar!

We stood there, dumbfounded. Gradually the sound decreased as the frightened creatures returned to their places.

We had solved our major problem—and a minor problem as a result: the infernal smell in the cave. It was "the concentrated perfume of bats," as Rodriguez phrased it. The floor of the cave was composed mostly of bat droppings, the accumulation of nobody knows how many years.

A more difficult question was the cockroaches. What did they live on? It seemed improbable that there were enough fallen baby bats or dead adults to keep them alive. It seemed likely that they found pieces of bugs in the droppings of the insect-eating bats, and Rodriguez offered a further possibility. Scooping up a handful of bat guano from the floor, he said:

"Do you see all these rough-looking little sticks mixed in with the droppings? I think they are *jubo* berry cores." (These berries grow on trees and have fibrous cores something like American mulberries.) "Many of the bats are fruit eaters," he continued. "Perhaps they bring back berries to chew on; the cores drop to the cave floor, and the little *cucarachas* suck the remaining juice." In any event, the cores got into the cave somehow, and the roaches must have enjoyed them.

On our way back along the cockroach corridor, I walked close to the right-hand wall, looking into holes and cracks where the ancient Indians might have stowed away something of interest, as indeed they had hidden the wooden platter. Coming to a larger crevice, I peered in and found myself face to face with—a big snake neatly coiled in the opening, its nose not ten inches from mine! Jumping back, I called Rodriguez. He investigated cautiously.

"It's what we call a *majá*," he said, "a relative of the boa constrictor. I'm going to try to catch it for the zoo in the Parque Colon at Havana. Don't worry, it's not poisonous. In fact, we have no poisonous snakes in Cuba."

He waved his left hand in front of the hole while Juan shone his light upon it; he kept his right hand at one side, out of sight. I saw the snake raise itself, watch for a moment, then stick its head out of the crevice to see at close range what was going on.

Instantly Rodriguez grabbed it by the neck, and the struggle began. After some minutes, seeing that my friend could not make it alone, I took hold also. How long we pulled and sweated, I don't know. Sometimes we had the snake nearly out of the hole; then, in a panicky burst of strength, it nearly got away from us again.

Finally Rodriguez had an inspiration. Calling Gaspar, who was still carrying the canvas sack, we slipped the snake's head inside it, then turned the reptile loose. Apparently content to find peace and quiet in the sack after so much commotion, the reptile let go with its tail and of its own accord slid its eight feet of length into the receptacle. Rodriguez tied up the sack, and that was that.

As we headed again for the entrance, a loud roar from behind startled us. We knew now what it was, yet, instinctively quickened our pace. In fact, we were almost running when we emerged into daylight.

Once in the cool cave mouth, we sat down to recuperate. Gaspar,

Continued on page 335

gingerly depositing the snake bag on a smooth spot, announced, "Now, with permission of the señores, I shall bathe myself." He shed his cotton coat and trousers, kicked off his *alpargata* shoes, and stepped into a pool of water on the east side of the opening.

The rest of us, equally sweaty and dirty but less ambitious, watched him with envy. Suddenly I noticed, on the cave wall beyond the pool, something unusual. The whole surface was covered with ancient Indian carvings, known to archaeologists as "petroglyphs." They were in plain daylight, although partially hidden by an encrustation.

Now, with renewed interest, I looked about the cave mouth for further traces of ancient Indians. Not fifteen feet away, I was astonished to find that a large stalagmite we had passed several times on our way into the cave was crudely carved to represent a human figure! It not only had a plainly marked face but indications of a body carved upon it. It was the *Zemí,* idol of Cape Maisí.

The stalagmite, about 4 feet high, stood some 50 feet back from the shelter line of the cave mouth, in plain if subdued sunlight. Most of the carving was on the surface of the stalagmite that faced east. Here we found a plainly marked face made by pecked-in grooves clearly representing the mouth, nose, and eyes. Other grooves suggested limbs and male genitals, and still another encircled the forehead like a headband. This image was so placed by nature that at a certain time in the morning, at least during our stay in June and July, a shaft of sunlight striking through a crevice fell full upon the face of the figure for a few minutes.

The north, south, and west surfaces also bore rude faces indicated by shallow depressions, but these were less detailed than the east face. In order to photograph the north face, for example, we had to whiten the grooves with cassava starch.

Who made the idol? We consider it a product of the Taino Indians, who had carved the beautiful wooden platter, but the workmanship is crude for such skillful craftsmen. Perhaps it dates back to the days of the Ciboney tribe—the much more primitive people who occupied eastern Cuba before the Tainos.

It seems probable that the mysteries of the hot, dark, subterranean chambers—the roaring sound, the millions of cockroaches, and thousands of bats—existed in Indian days as well as now. If so, these awe-inspiring phenomena may well have caused the selection of this particular cave as a special spot for "cavern worship," known to have existed also among the related Indians of Haiti.

But alas for my dream of finding a real prize for the Museum! I had pictured a statue of stone or wood that could be picked up and carried. The idol, being a stalagmite, was anchored to the rock bottom of the cave! Moreover, it must weigh 400 or 500 pounds—far too heavy for any pack animal to carry, even if we could pry it loose. And if we succeeded in finding a strong enough pack animal, there was still no trail from La Patana to the outside world.

All I could do was to photograph the idol and the carvings; and when we returned to Finca Sitges, I mentioned them in my routine report mailed to the Museum. Regretfully, I thought that was the end of the matter.

But I was wrong. Coming in from a trip one day, I found a cable from Dr. Heye, the Director. "GET THAT IDOL" was all that it said.

Plainly, a trail was the first necessity, so we went scouting and found that to build one up the cliffs was out of the question; it would take too long. Our only hope would be to follow the terrace of La Patana eastward and connect with the old trail leading from the top of the plateau to the lighthouse at Cape Maisí. That would take only days, not weeks. So we got busy rolling rocks aside and where necessary cutting a path through tropical growth with machetes. In one place, where the limestone underfoot was full of holes and

Continued on page 335

Chrysan

By WOODY WILLIAMS

HAVE you ever reached out for a flower, only to have it vanish as if touched by magic? Well, try to take hold of *Eudistylia.* However, botanists need not search their check lists for this unfamiliar name, for *Eudistylia* is not a plant.

I found it when wading in the shallow waters of a California bay. The bottom was carpeted with broad fronds of bright green sea lettuce. Among this growth were gay "chrysanthemums"—some orange, some maroon with orange bands. I knew that many things in the sea are not as they seem. Seaweeds twist over the surface to suggest serpents. The coral gardens of the tropics are not gardens at all but teeming menageries. These creatures, extending from the sandy mud of a shallow bay, certainly appeared to be escapes from some autumn garden. But how could they live beneath the sea?

I shuffled toward one and bent down to take it in my hand, but I came up with only a piece of sea lettuce. I pushed toward another, the sun behind my back. This time the flower head vanished before I had come even within reach. These chrysanthemums in the sea were a lie. Did they exist at all, or was I a victim of my imagination?

Meanwhile, the tide receded. Among the limp sea lettuce on the sticky bottom, I saw some tubes projecting above the surface. A bit of color dripped dejectedly from one tube, but as I approached, it slid out of sight. This, then, must be my flower. And I resolved to dig it out with a shovel.

Blisters developed on my hands, and yet the tube went down and down, curving here and there to circumvent a rock. The hole I had

hemum of the Sea

A flower that moves or an animal whose head is a blossom? This perplexing creature looked liked a fugitive from an autumn garden, but it lives its curious life in a California bay

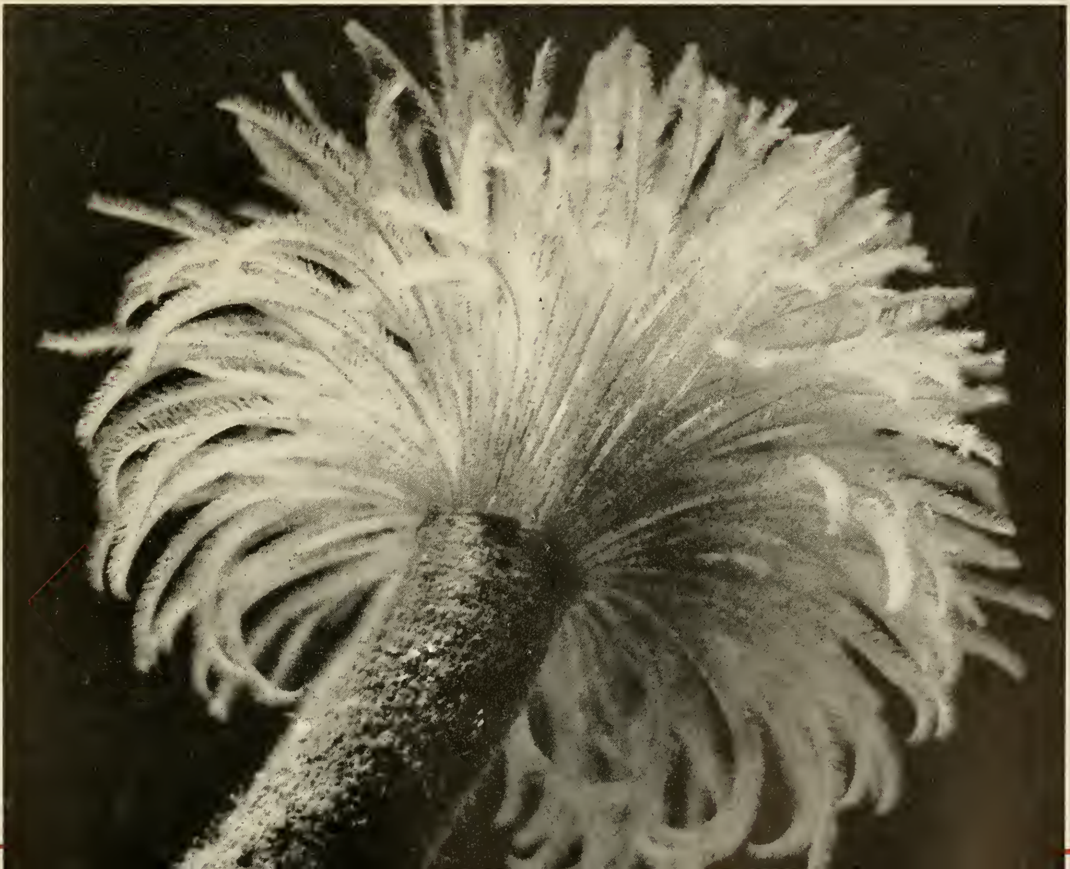
dug finally extended to arm's length and beyond. Still the tube descended endlessly. In exhausted desperation, I tugged with all my might. It gave, and I sat down in the mud. In my hand was a parchment-like tube with a broken end. Its full length would have been about three feet. And hanging from it was the broken body of a worm as thick as my forefinger.

The animal slipped out of the tube, and there was my flower! When placed in a jar of sea water, it soon extended again into its former glory. The shape well suggested the local name, "Feather Duster." The worm did not seem greatly to mind the loss of over half of its length, which might have totaled two feet.

This creature was jointed like a "clam worm" or even an earthworm. On the side of each joint were appendages called "parapodia," with which the Feather Duster managed to propel itself up and down in the tube.

Numerous dots covered the tentacles of this gigantic worm, as if pepper had been sprayed over the head. Further examination revealed that these dots were simple eyes—the secret of the Feather Duster's disappearing act. These eyes were the worm's warning system, so that it could flash out of sight at the approach of a mere shadow.

The next time I meet a friend who hasn't seen anything extraordinary for a time, I will take him to a mud flat where *Eudistylia* lives. He will then see some of the strangest sights there are to see, and he will discover that even a worm has learned to lift its head nobly above the muck of a California bay.



My Friends
The Land Otters

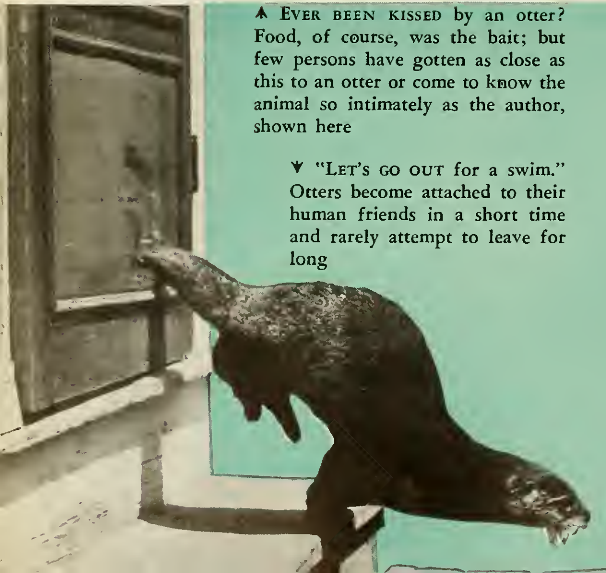
To know the land otter is to love him—and also to condemn the persecution that has all but eliminated him from the American scene. At least that is what the Liers have found since, quite by chance, they started a rapidly growing land otter colony in 1928

By
Emil Liers

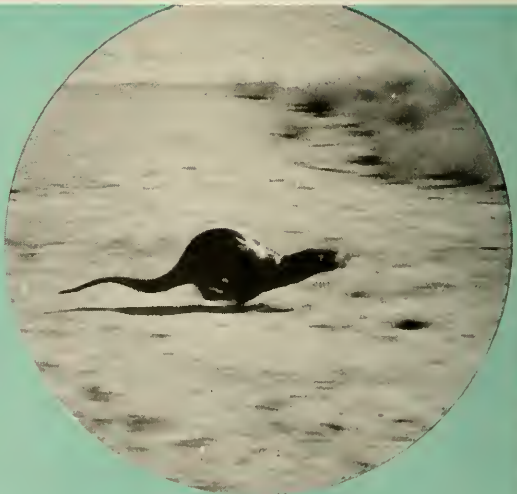
IN 1928, two young land otters (*Lutra canadensis*) came into my possession, and before long my wife and I became so fascinated with them that we undertook to obtain more otters as pets in order to study and to try to raise them. Since then we have had about 150 animals of all ages, as many as 35 on hand at one time. We have had 29 babies born in our colony, in-

Gatterdam photos

▲ Ever been kissed by an otter? Food, of course, was the bait; but few persons have gotten as close as this to an otter or come to know the animal so intimately as the author, shown here



▼ "Let's go out for a swim." Otters become attached to their human friends in a short time and rarely attempt to leave for long



▲ In full stride, the land otter becomes a rhythmic undulation of curves cluding those of the second generation. We have found the otter invariably intelligent, generally cooperative and friendly, and always fascinating.

At our home near Homer, Minnesota, on the bank of the Mississippi, we have wire enclosures with wooden den boxes. I travel about the United States taking otters to schools, sportsmen's gatherings, and science meetings, where I tell what I have learned about them and let the otters visit with the people. I also take them to streams and lakes where they can swim, hunt, and have a good time. They have been extensively photographed, in both stills and movies, and have entertained and instructed many thousands of people. In working and living in such intimate contact with them, I think we have had a better opportunity to become acquainted with otters than any other living persons.

Otters have always been blamed for killing a lot of fish; and we naturally started out with the belief that our animals would eat mainly fish. But when we fed them fish, we had many sick otters and lost some. Finally, after many unhappy experiences, we found to our surprise that very few otters can survive on a diet of fish. Doctors and others doing research on diets, both among our otters and elsewhere, have confirmed this fact.

We found that the favorite and principal food of otters is crayfish, which feed extensively on young fishes. Thus, instead of being destroyers of fish, otters actually help to protect them. When an otter occasionally takes a fish, it is usually one of the sluggish kind that are rarely or never used by people, and some of these fish themselves devour young fish. Karl F. Lagler and Burton T. Ostenson, in a study of the food eaten by otters taken during trapping operations late in March and early in April, showed that the animals had eaten some game and panfishes, small fish such as minnows, mud minnows, and sticklebacks, frogs, salamanders, crayfish, insects, and some miscellaneous vertebrate material such as hawks and a goldeneye duck that had probably been picked up dead[1]. Since this study was made under late winter conditions, when crayfish and frogs are very scarce, the proportion of fish is probably far higher than the average for the year. Our own observations show that, in addition to crayfish and frogs, they eat snakes, turtles, mussels, snails, insects, worms, and some fruit and vegetable material such as roots, tender shoots, pond weeds, and algae.

My otters kill snakes that we meet along the streams and lakes. When they find a big snake, they chatter, call for help, and circle warily until the snake strikes several times. Then they kill it by biting the head. If hungry, they eat many of the snakes they kill.

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[1] "Early Spring Food of the Otter in Michigan," by Karl F. Lagler and Burton T. Ostenson, *Journal of Wildlife Management*, Vol. 6, No. 3, July 1942, pp. 244-254.

Gatterdam photo

▲ THE AUTHOR allows his otters to swim freely in the Mississippi and other streams. One went astray for eleven days but was glad to get back home

◀ LAND OTTERS care far less for fish than they do for crayfish, frogs, salamanders, insects, etc. Thus the bad reputation they have among anglers is quite undeserved

We have found that they thrive in captivity on a diet of 74% horsemeat, ½% liver, 8% bran, 10% raw rolled oats, 2% bone meal, 1 ounce brewer's yeast per day per ten otters, ½% tomato, lemon, orange juice or ½% of raw grated carrots, and one teaspoonful cod liver oil daily per otter. We add enough whole liquid milk to this to make a soft mash.

Sick otters, if taken in time, can often be saved with this diet.

Females that have just given birth are fed abundantly every three hours. For the first feeding, I put more whole milk in the mash and add 10% Pablum. Three hours later, I give the animal four ounces of calf or beef liver. Then comes a feeding of bread and milk; and in another three hours, raw meat. Next, I give the otter a tidbit, like frogs and crayfish. Later, as a nightcap around 9:00 P.M., comes a regular heavy mixture with Pablum and milk and 2% bone meal.

As might be anticipated with animals so very active, otters have big appetites and rapid digestion. Crayfish are digested and eliminated in about one hour.

Unfortunately, the false idea that otters destroy large numbers of fish has given them a bad name and deprived them of the proper protection. Hunting by sportsmen and the excessive trapping of otters for their fur have exterminated these valuable animals totally over large parts of their range, and only a few remain in the less settled regions. There are probably not more than 2000 otters in the United States. In Canada and Alaska their value as fur bearers is recognized, and small populations of otters have consequently been preserved, but not nearly as many as there should be.

Otters tame readily and after a short time become so attached to their human friends and their new home that they make no attempt to leave, even when the gates to their pens are left open. I freely take them for outings in the Mississippi River and other streams and lakes. Occasionally one strays away, and they have been gone for as long as eleven days. However, they seem to be very glad to rejoin me, and all I usually have to do is to keep searching or waiting in the vicinity of the streams and ponds, and sooner or later we meet. My whistling and calling causes them to return to me voluntarily, and usually they make such a display of affection that I know they are glad to be back with me and their other playmates.

Both young and adult otters are very active and playful. They are always ready for a romp with others of their kind, or with a dog or other animal acquaintance, or a human friend. While they are powerful and able to inflict serious bites, they rarely do so, and they use care not to injure a friend even though appearing to be in deadly earnest in a scuffle. Adults playing with young give them vigorous exercise but never appear to hurt them. Similarly, in playing with human friends, they may inflict hard pinches and even minor injuries, but these are never the result of unprovoked viciousness. However, when a mother otter is trying to keep a person away from her young, beware. She

▲ THE TAME OTTERS ARE QUITE ready to be friendly with a dog or a racoon

➤ BEGGING FOR tidbits at the table

is powerful and capable of inflicting severe bites and will not hesitate to do so if she thinks it necessary to defend the babies.

Mother otters are excellent parents. When the babies are small, the mother curls her body into a perfect "doughnut," enclosing the little ones so they are protected from the cold and can nurse. If mild danger threatens, mother otter places her head over the hole in the doughnut in which the babies are lying, thus completely hiding and protecting them.

The newborn babies do not open their eyes until the 25th to 35th day. At 85 days, I have had otter babies out with their mother at ponds and streams, and the little ones had grand times playing about on the bank, but they would not go into the water. Mother would catch a crayfish and bring it to them and would roll and play with them. When they are about 100 days old, mother acts as though the youngsters should begin to enter into real otter life. She tries to coax them into the water; and if they do not go in, she catches them by the back of the neck and drags them. After a few such introductions, they become enthusiastic swimmers and make short dives. Even when the babies are older, the tamest mother otters I have will not permit me to play with their children. They growl at me, and if I disregard the hint and put my hand near the young, mother grabs me gently but firmly and forces my hand away. If I still don't take the hint, she bites hard and is ready to fight. If the children are away from her and approach me, or if I try to coax them to me, she calls and talks to them, plainly warning them to stay away from me. If they disobey and approach me or allow me to approach them, she punishes them when she gets to them by shaking and scolding them.

I do not believe that the male ever lives in the den with the mother and young, but he is near by most of the time. When the young ones come out of the nest, father often joins the family party, romping and playing with the babies and helping to teach them to swim.

Surprisingly little is known about the life history of this valuable and fascinating animal. Mating usually takes place in the water, and the gestation period, according to numerous observations I have made, may vary from nine months and eighteen days to twelve months and fifteen days. Perhaps this is not so surprising when we recall that the gestation period of mink, in the same family, ranges from 38 to 87 days and that of the marten from five to nine months. I am certain that otters breed every year after the second year. Mating takes place almost immediately after the young are born, as is the case with the fisher. In the northern states, the young are born in February, March, and April. Litters vary from one to four, usually two or three. One baby about a week or ten days old weighed six ounces, and ten days later she weighed sixteen ounces. They mature and are ready to breed when about two years of age. Full-grown otters range from about 16 to 50 pounds.

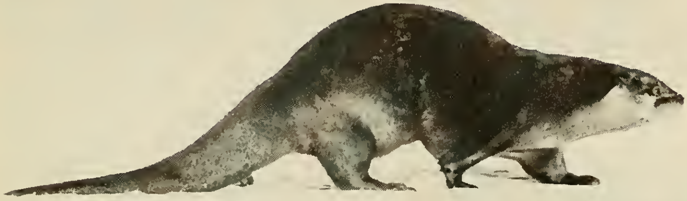
Tara, the first otter to breed in captivity, has produced four litters for me and is now seventeen years old. She shows no signs that her reproductive cycle is ended. This to me points to quite a long life for an otter—about the same apparently as a horse.

Otters are vigorous, healthy animals and in captivity have few ailments, except those that can be traced to improper feeding. Usually the mistake is to feed them too

◄ THE STRONG TAIL is a useful balancing organ when the animal wants to periscope the landscape

➤ THEIR BITE is gentle, unless the mother is defending her young

▲ AN OTTER CROSSING the ice at a beaver dam. The otter will show interest in a muskrat or a beaver, but will not try to kill it



E. P. Walker photo

▲ LAND OTTERS project their streamlined bodies through the snow as though it were water. They wallow in the deep drifts with the same enjoyment that a young boy shows

▼ THE GREATEST SPORT for an otter is to climb a steep snow bank and slide down it with arms folded back against the body. But they never do this alone

Gatterdam photo

much fish or meat. With an excess of either, especially of fish, the animals apparently develop an acidic condition that often results in partial paralysis of the limbs, the loss of teeth, and very often death.

Unlike many other carnivores, otters get along with one another very well. I often have a dozen adults and large young in an enclosure or on an outing with me, and there is rarely any serious fighting. On the contrary, they have delightful times playing together, engaging in mock fights, swimming, diving, catching crayfish, frogs, snakes, and insects, and sliding down banks into the water or sliding on the snow or ice. They are always doing something, and it is always interesting.

Most of my otters enjoy riding in the automobile, and some like to go hunting so they can retrieve ducks or pheasants on either land or water.

The one sport in which both wild and captive otters seem to indulge most is sliding. It is a real treat to see them climb to the top of a slope—a steep stream bank or snow-covered hill—then head down, sliding on their under surface with their arms folded back against the body. The late Ernest Thompson Seton says, "Whether the otter slides from the top of a mere snowdrift into the adjoining hollow or down a muddy bank into a stream, or best of all down a long icy hill to plunge into deep, cool water below, it is evidently done for sport, for the joy . . . of flying through space without labor and without violence and with the very same exhilaration that such a thing would give to mankind. To this the creature fails not to add the crowning charms of good company and of friendly rivalry, for so far as I can learn, no one has ever yet seen an otter enjoying its slide alone."

Playing in the snow is grand sport for otters. They dive into it, travel through it, and emerge just as though it were water. They wallow in it with the same obvious enjoyment that boys and dogs show when playing in the snow.

➤ Who is interested most, the man or the otter?

Gatterdam photo

▼ A fine foot for swimming

Otters are friendly creatures and want to be friends with other animals—dogs, raccoons, cats, minks, even bears. It is fun to watch dogs and otters make friends. After a few meetings they are the best of friends, and they have a wonderful time playing together. Very seldom does a dog prove unfriendly toward an otter.

The otter is sociable. Bring a strange otter into the place, or a couple of cubs, and every otter is interested—male and female. They want to get acquainted with the babies—smell and roll them around. The little cubs lie supine as the old otter grunts and lopes away. The cubs follow, playing and chuckling their delight at finding a new mother or father as the case may be.

They are so very vigorous and have such a keen sense of enjoyment in activities that amusing incidents are endless. I could fill a whole issue of Natural History with otter lore, but a few incidents must suffice.

While making a "Sportlight" motion picture at Silver Springs, Florida, I took my otters and my Airedale into a large enclosure where a bear had denned up in a cypress bole. The cameraman was watching from a platform built outside the fence so he could look and shoot over the fence to film the picture, while the Director followed me with the Eyemo camera. We were all anxiously anticipating what would happen. The otters smelled around the big cypress, chattering to one another. Then they took a turn about the large yard, in one end of which was a long Cypress log over a muddy corner where the bear had wallowed in the mud. After that they went back to the bear's den in the cypress and chattered to each other. Then little Tetawish popped into a hole in the tree. The others quickly followed. No sooner had they entered than there was a "Woof!," and out popped the bear on the side facing the cameraman. With the otters following close behind, the bear ran on all fours, humped up, to the wallow and paced back and forth on the log. As the bear came to where the otters were below the log, first Jocho, then Tetawish reached up and nipped him on his paws. Every time they did that, he would raise his paw and shake it and run faster. The otters were having a lot of fun —not so, the bear. He jumped off the log and began to pace back and forth about the yard.

This all happened about as quickly as I can relate the story. I was thrilled, thinking of the interesting picture we had. I looked up at the cameraman, shouting, "We really got a picture that time."

But I was doomed to disappointment. He drawled back, "We have to do it over. I just watched to see what would happen. I didn't take any pictures."

That is what I mean when I say you have to rehearse everything for a Hollywood camera crew. There was a sequence worth thousands of dollars that went into thin air. A picture that will live forever in my memory—but not on the screen.

One day when we were on location, the photographer was busy grinding his movie camera when Jocho came up, grabbed his Zeiss still camera by the strap, and ran, dragging it into the pool of water with the photographer chasing her, laughing for all he was worth. Finally he caught up with her, but not until she had dragged the camera through the pool to the other side. I was surprised that he could consider it such a joke, but everyone loved Jocho. As he stood there laughing and looking at the damage done to the camera, Jocho swam back to the movie camera, grabbed his notebook, which was lying on the ground, and took it into the pool. So another chase was on to get the notes. We caught up with Jocho and captured the notes, a little the worse for wear.

One day I had a number of my otters out on the river front. They were busy swimming as I read under the shade of a tree. Soon several of them gathered around me, rubbing and drying and chattering away. I could tell by the talk that something was wrong. I called for the others but received no reply from four of them. Jocho and three cubs were missing. I called and searched—no Jocho.

Then someone called to me from the U. S. Fish Hatchery at Homer. They said Jocho and the cubs had come to visit them, much to the children's delight. The children had played a bit with Jocho and then placed all their attention on the cubs. Jocho did not mind that. While the children were busy playing, Jocho opened their screen door and went upstairs to the bathroom and took a bath in the toilet bowl. Then she went into the bedroom and dried off between the sheets of the bed. That was Jocho, just as playful at twelve years as she was at twelve months.

It was soon after I had begun taking my otters out to play in the streams that I learned they did not harm fish. But I often met fishermen who would scowl and otherwise show hostility. At first I did not guess why they were angry. Finally I found that fish protective officials had had wardens watching me with the view to filing charges against me when they saw my otters chasing and killing fish. But these same officers later admitted that in all their watching they had seen no evidence on which to base a case.

In eighteen years, even though I have had as many as sixteen otters in a stream at one time, I have only seen them catch three trout. Once, an otter plunged off a bank into a pool where there were several trout and came to the surface with one in his mouth. The second time, it was a crippled trout that was caught. The third fish was caught as the otters were swimming upstream. They came to a riffle. A brown trout of about a pound became frightened and swam up the riffle, hit a shelving rock, and skittered out on shore, where an otter caught it.

Otters occasionally catch a sucker or bullhead, but very few other fishes. They catch and eat many pollywogs, frogs, snakes, crayfish, angleworms, caddis flies, and an occasional snail.

I have never seen where wild or tame otters have pursued and killed birds and animals in the wild streams and lakes. Sometimes a muskrat or beaver has shown up. The otters are interested but do not try to kill it. The same holds true for other animals and birds.

I have seen the otter catch thousands of crayfish (their favorite food) and hundreds of snakes, both poisonous and nonpoisonous.

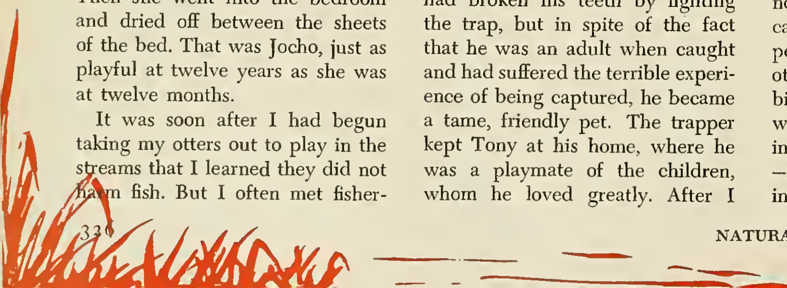
I obtained Tony from a trapper who had caught him in a steel trap when he was about three years old. His left foot was injured, and he had broken his teeth by fighting the trap, but in spite of the fact that he was an adult when caught and had suffered the terrible experience of being captured, he became a tame, friendly pet. The trapper kept Tony at his home, where he was a playmate of the children, whom he loved greatly. After I obtained Tony, I had him and some of the other otters with me at the Bronx Zoo in New York for two summers. Sometimes little children would run out on the lawn with the otters and roll and tumble with them. Tony would go to the toddler as he plumped on the grass and snuggle the child's face and caress his cheeks. He never forgot children.

Mrs. Rae Riggs, of Everglades, Florida, had pet otters that accompanied her to the post office for mail. When cars passed as they walked along the street, the otters would scurry under the shrubbery until the danger was passed. Like all otters, they loved to play in the house. Jocho would come in at bedtime, gather all her mistress's clothes, stack them in one corner of the room, and curl up and go to sleep on them. The night of the hurricane, Jocho and Jimbo became so frightened that they forced their way through the wire fabric of their pen. Jocho ran for the house, tore through the screen door, ran to Mrs. Riggs's bedroom, wet and chattering, climbed on her bed, and snuggled under the covers at her feet. Poor otters. Even after I brought them north they always got frightened in a thunderstorm.

Otters in zoos regularly beg for attention even though they have not been petted.

I have often been impressed by the memory of otters. On one occasion a young otter was brought to me, and after I had it three weeks the mother was captured in the wild and brought to me. She immediately recognized her baby, and there was a grand reunion.

Quite often we are startled as someone asks what we receive for our otter pelts. How can people think we could skin our babies, the sweetest most intelligent animals that ever lived? Of course we are not such idealists as to believe we can stop the harvesting of fur. But people would do well to observe the otter and many other animals and birds more closely. Doing this, they would learn that the otter is an important factor in nature's scheme —a protector of fish and a fascinating woodland neighbor.



enjoy them

WHILE THEY LAST

Our slaughtered shorebirds sound a grim warning for the vanishing wildlife of Alaska. Today the same lies are being invented by men unwilling to admit their own guilt in the killing

By Ben East

AMNH photo

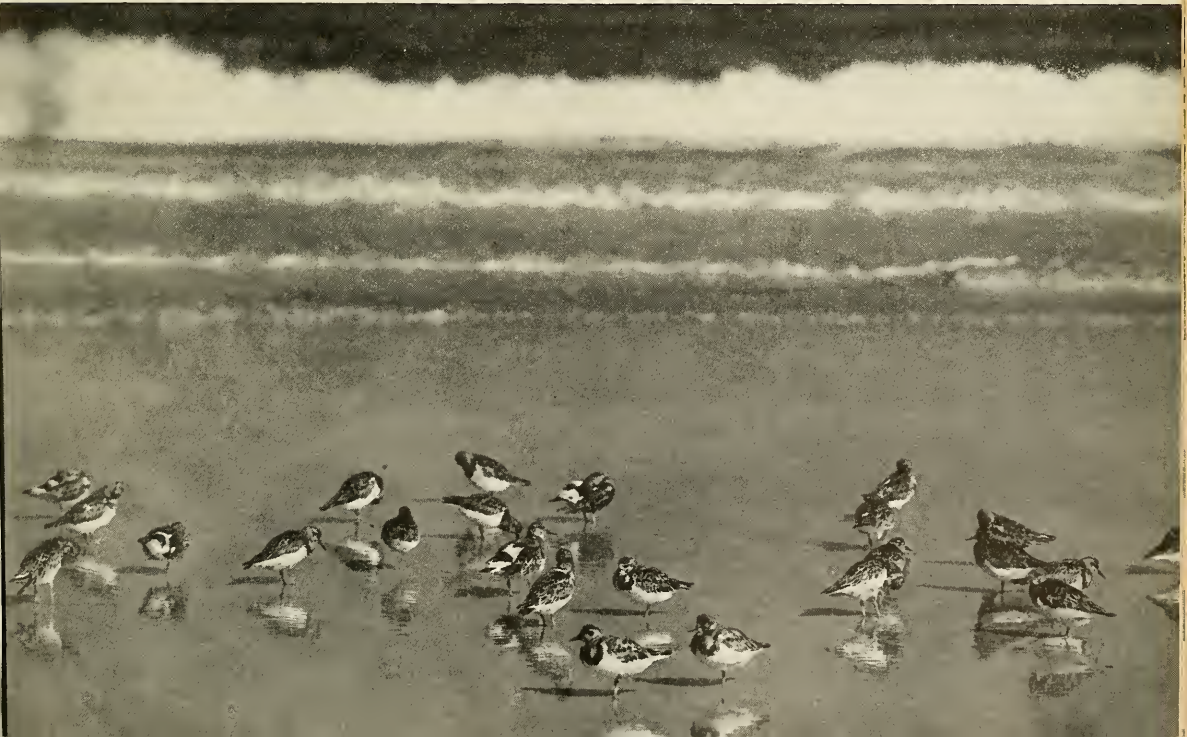
▲ The Eskimo curlew (*Numenius borealis*) can now be seen only in a museum. Of the many shorebirds decimated by market gunners in the late nineteenth century, it suffered most severely. It is now probably extinct

UNLESS you are an old man, you were born too late to witness the great autumn flight of the shorebirds over the dun marshes of Cape Cod, the rush beds of Lake Erie, or the prairie sloughs of the Dakotas.

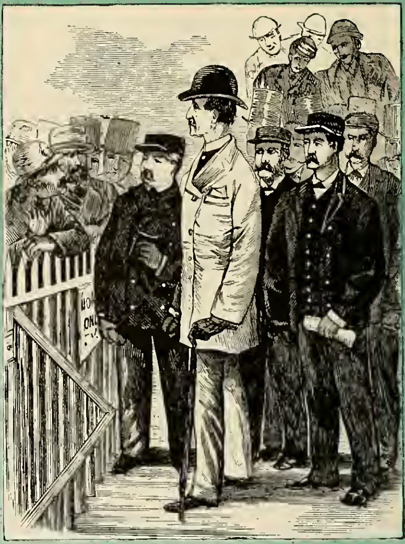
Fifty or one hundred years ago, massed legions of curlew and plover, yellowlegs and snipe, wheeled and dipped above the salt meadows and mud bars in the bright blue days of September, in numbers that challenge the imagination and defy

▼ Ruddy turnstones. In the days of abundance, the Boston market offered turnstones at 10 cents a dozen

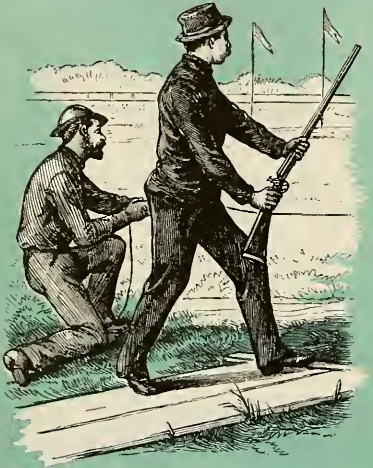
Allan D. Cruickshank from National Audubon Society



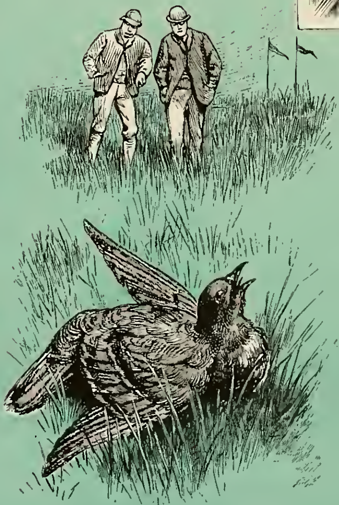
These drawings from 1881 show the conflict between a shooting organization that called itself the New York State Association for the Protection of Fish and Game and Mr. Henry Bergh, founder and president of the American Society for the Prevention of Cruelty to Animals. In this tournament at Coney Island, 201 contestants shot at 2000 live pigeons for prizes valued at $1490. During the shooting, men and boys cruised the field with sticks to kill wounded birds. A sensation was caused when small boys distributed a pamphlet by Mr. Bergh urging American citizens to "abolish this cruel and unsportsmanlike pastime."



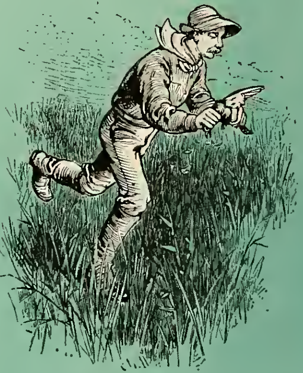
Mr. Bergh
was refused admission to the grounds



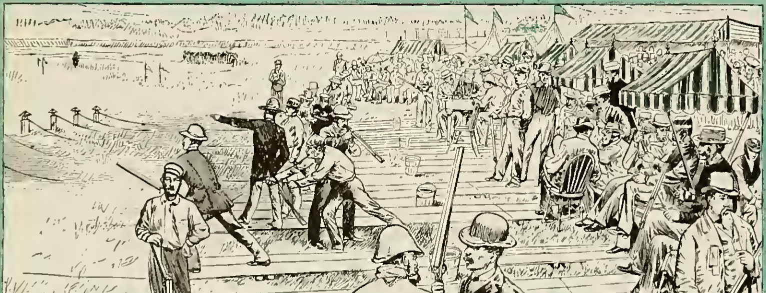
"Are you ready?"



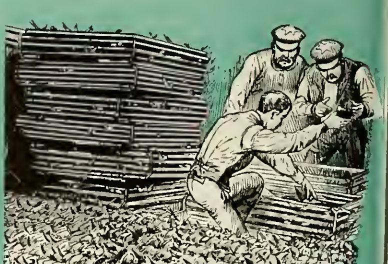
A disputed shot



Chasing
and killing wounded birds



General view of the tournament grounds



The victims of the day's sport

Allan D. Cruickshank from National Audubon Society

▲ BIRDS like the sanderling might have shamed the hunter by their size alone, but they stood high on the "game" list

description. The shorebird flight then deserved a place among the truly great wildlife spectacles that graced this continent. But it was gone before our time, sacrificed to the greed and short-sightedness of a generation that had neither understanding nor the will to practice restraint, dissipated by men to whom the sagging game bag was the only measure of a successful day afield.

Much the same thing is happening, many conservationists believe, in Alaska at the present time. And the same alibis are being given. We are told that bald eagles are destroying the white sheep, that caribou have taken new migration routes, and that the moose are simply falling victim to the wolves. So the tales run, echoing the selfsame theme as the stories men told 50 years ago to account for the tragic decline of the flights of plover, curlew, and yellowlegs in the United States.

Today the shorebird legions are a tattered remnant. Of all the clan only one, the woodcock, remains on the legal game list for hunters in the United States. And charming, wily gamester that he is, he is so unlike the others of the tribe, both in his way of life and in the kind of shooting he affords, that for practical purposes he should hardly be ranked as a shorebird.

Of the rest, the Eskimo curlew has probably gone beyond the help of protection. It is 20 years since the last specimen was taken; and though we have had reasonably reliable sight records within the past few years, practical conservationists fear that this bird may have joined the ghostly company that includes the great auk, the passenger pigeon, and the heath hen.

The others—the plovers and yellowlegs and Wilson's snipe—missed the same fate by a margin too narrow for comfort. Depleted by a slaughter that has hardly a counterpart for wantonness in the history of American field sport, they won respite from the guns only when their numbers had shrunk to the danger point and beyond, when they had dropped so far that it has taken years of protection to produce signs of a comeback.

Even if these birds returned to the full carrying capacity of the land, their marshes are now so limited in area that they could never regain their former abundance. The continual conversion of land to man's uses makes the birds increasingly dependent upon sanctuaries and refuges where the natural conditions are preserved.

I shall speak from now on in the past tense, even of those birds that remain, because it seems fitting to do so. They still perform their aerial drills above our autumn marshes, a fragment of a once great host, but the big flights are vanished to return no more. There are tens today where once there were tens of thousands. Vast reaches of marsh and prairie are empty and silent where once the sweet voices of these birds made an unending melody from dawn to dusk of each spring day. Skies across which their migrating flocks once drifted like swarms of overgrown bees know them no more. All things taken into account, the past tense seems to suit the shorebirds better than the present!

Natural-born wanderers, strong and swift in flight, they came close to claiming the championship of the feathered world for long-distance travel. Many of them nested on the sun-bright moorlands of the arctic and wintered below the equator.

▼ WILSON'S SNIPE, long-billed recluse of the marshes. One gunner bragged of shooting 366 in a single day. In 20 years this one hunter killed over 69,000

Allan D. Cruickshank from National Audubon Society

Allan D. Cruickshank from National Audubon Society

▲ The lesser yellowlegs claimed an extensive winter range from the southern United States to the tip of the South American mainland. One hunter killed 106 at one time by firing into a flock on a beach

▼ The golden plover. Audubon estimated that 48,000 were shot in a single day in one Louisiana marsh

AMNH photo

Only the Arctic tern, capable of feeding from the sea itself, made a longer seasonal journey.

The Eskimo curlew, for example, was known in the United States only as a migrant. Its breeding ground was on the Barren Lands of Canada west of Hudson Bay, and its path of migration was a strange one. Quitting in July the remote and lonely land where they had bred and reared their young, the curlews headed eastward across the Canadian arctic, arriving on the coast of Labrador by early August. There they fed and loitered for a brief time, blanketing the hillsides and gorging on the purple-black fruit that came to be known as the curlew berry, until they were stained from bill to toe with its dark juice. By the time they left Labrador they had grown so fat that, tumbling from the sky at the hunter's shot, their breasts often burst open like overripe melons. In that fashion they acquired the name of doughbird.

From Labrador the migration moved across the Gulf of St. Lawrence to Nova Scotia, on the way to the far-off winter home of the clan. What happened next depended on wind and weather. If storm or fog hindered the birds, they followed the coast south, and at such times hunters on Cape Cod and other favored places in New England shot curlews by the wagonload.

If weather favored them, however, the doughbirds did not include the New England coast on their south-faring route. When they vanished from Nova Scotia they were not seen again until they made landfall on the coast of South America, 2000 miles away. Strong westerly gales, overtaking them on the flight, sometimes drove them as far off course as Iceland and the British Isles, but still they survived. Mid-September found them on the pampas of southern Argentina, 8000 miles from the tundra of Canada where they had pastured two months before.

The route of their spring flight was completely different. From the grassy plains of Patagonia, they came up across South America and reached this country in the region of the Texas coast. They then passed directly north to their nesting grounds through the prairie country west of the Mississippi. The Atlantic coast saw them in spring only as stragglers.

The golden plover followed an almost identical flight pattern and, in the old days, shared migration lanes and summer and winter home with the Eskimo curlew. Hunters looked confidently to find the two together.

The black-bellied plover, rated by many gunners as king of all the shorebirds, had a wider range and made a shorter flight. It laid its four spotted eggs in a moss-lined bowl on the tundra along the arctic coast of Alaska and Canada west of Hudson Bay. It migrated all across the continent and was seen everywhere from Cape Cod to Puget Sound, both spring and fall. Its winter home was in southern United States and northern South America.

The yellowlegs, both greater and lesser, known to hunters as the tattler because of its noisy ways, nested on the patches of muskeg that are scattered within the northern coniferous forest zone from Alaska to Newfoundland. On the salt meadows and over the countless small ponds of that lonely but beautiful land, its sweet clear call notes were a common sound through the long bright days of June and July. The greater tattler, lingering longer on its nesting grounds and reaching the United States later, earned the name of winter yellowlegs. The lesser was often called the summer yellowlegs. Both claimed an extensive winter range, from the southern United States all the way down to the very tip of the South American mainland. Many individuals made an annual round trip of 12,000 to 16,000 miles.

Magnificent travelers, the shorebirds, harboring no dread of distance and following migration lanes that led sometimes above marsh and prairie, sometimes over the empty leagues of the sea itself!

All the members of the great host had certain traits in common—qualities that endeared them to gunners and made them exceptionally vulnerable as targets. They traveled, migrated, and fed in flocks, many of them in close-packed bands from which it was no feat to drop a score with a single shot. They were swift of flight, wheeling, turning, dashing above the marsh, providing sporting targets. Yet they were easily whistled up, came readily to decoys. Often they were so unwary that when part of a flock dropped dead or wounded, the survivors came wheeling back time after time, calling plaintively to their fallen comrades, only to fall themselves in turn, until no more than a remnant remained to flee to the uncertain sanctuary of the outer mud flats.

They were conspicuous birds, most of them silvery-white below and dark above, flashing in the sun as they pivoted and drilled over the marsh meadows, sure to catch the gunner's eye and whet his shooting lust. And finally, they were fat and well-flavored, succulent table birds. Long years they hung in the market stalls of Boston and New York, Chicago, St. Louis, and other cities by the thousands and tens of thousands. Long years the guns of the market hunters raked them through spring and summer and fall, setting a record of slaughter not by the brace, not by the score, not even by the hundreds, but by the barrelful and the wagonload.

The story of the shorebird killing is an incredible tale. No chapter in the long chronicle of our sorry dealings with America's wildlife is more shameful or reveals more starkly the greed of the lusty days of our country's youth, the total lack of consideration for the generations that were to come after!

There were no limits save those imposed by skill and luck, weather and chance. The hunter shot while the opportunity lasted; and if he apologized, it was not that he had killed too many but because he had not killed more!

None of the clan was immune. Birds smaller than a bluebird and not much more wary than a caged canary were struck from the sky by the hundreds, gathered up, and toted home in brimming baskets. While the hunters waited for plover or yellowlegs or curlew—the "big birds" of the shore—to come to the decoys, they whiled away their time with the peeps, as they knew the members of the sandpiper tribe.

The least sandpiper, no bigger

▼ HUNTERS shot the willet throughout spring, summer, and fall. Nest robbers hounded it for the eggs wherever it bred

Allan D. Cruickshank from National Audubon Society

than a sparrow, was prized because it flew in dense flocks. The tiny spotted sandpiper was a legitimate target, too, but less popular because it was more solitary in habit.

Sanderlings, turnstones, and killdeers, robin-sized migrants whose smallness alone should have shamed the men who shot them, stood high on the "game" list of the shorebird hunters. Turnstones hung in the Boston markets at ten cents a dozen. The killdeer, best known of all shorebirds, was shot so heavily both for sport and market that it all but disappeared over large areas of the country.

And while the lesser shorebirds were dwindling, the campaign of destruction was being waged even more savagely against the bigger members of the tribe.

Of them all, Wilson's snipe, long-billed marsh recluse known to gunners as the jacksnipe, supplied the greatest kill. Authorities say more snipe fell before the guns of hunters than any other game bird in the history of North American field sport.

Just to cite one fragment of evidence in support of that claim, there was a hunter who shot in the marshes of Louisiana, for "sport" and not for market, in the 20 years from 1867 to 1887, and published a complacent record of his kill. In one day, in December of 1877, he shot 366 snipe in 6 hours! He could have done much better, he explained, had he shot with two guns and used a loader. In 7 days of shooting that winter he accounted for 1943 jacksnipe. The winter's kill was 6615; and in 20 years, more than 69,000 snipe died to satisfy the egotism and blood-lust of this self-styled "sportsman."

Commenting on his kill, he unwittingly set down in clear and simple words the creed of his time toward all wildlife, the creed that sealed the death warrant of the great shorebird flights and shorebird shooting. "The snipe being such great migrants, and only in the country for a short time," he wrote, "I had no mercy on them and killed all I could, for a bird once missed might never be seen again."

All across the country, from Canada to the Gulf and from Cape Cod west to the prairies, there were thousands like that, some shooting for sport, some for a livelihood. It is little wonder the jacksnipe is no longer on the open list, little wonder the fall flight of yellowlegs has dwindled to a thin wisp that passes like ghostly smoke over the sea marshes of Monomoy. Little wonder if the Eskimo curlew is gone forever from the curlew-berry patches of Labrador and the mud flats of Nantucket!

Hugh M. Halliday from National Audubon Society

▲ Best known of our shorebirds, the killdeer was all but exterminated from large areas of the country

Allan D. Cruickshank from National Audubon Society

▲ Being solitary in habit, the tiny spotted sandpiper was hard to get, but it too was sought by the gunners

Allan D. Cruickshank from National Audubon Society

➤ Marbled godwit, pausing to feed on a beach

It was the misfortune of the sweet-voiced willet to nest within the borders of the United States, along the Atlantic seaboard. Not satisfied with hunting him throughout spring and summer and fall, including the full period of his breeding season, men set a price on his eggs as well, and nest-robbers hounded him wherever he bred.

The dowitcher, the brown-back of the hunters, was among the least wary of all shorebirds, returning to the guns time after time in response to a whistle that mimicked the cry of a wounded bird. Flying and alighting in compact formations, it was not unusual for 20 to 30 of these big snipe to fall at a single shot. Audubon saw 127 killed at once by the discharge of three barrels. The dowitcher went swiftly from abundance to rarity and missed by a hair's breadth joining the passenger pigeon in the Legion of the Vanished.

The story of the godwit was much the same. It was still sufficiently numerous in the '80's on the prairies of Minnesota that if its nesting grounds were invaded, it hung in bands of half a hundred above the traveler's wagon, where its loud notes of protest made a deafening din. Forty years later a man could have crossed all that prairie country and counted himself fortunate if he heard the alarm cries of a single godwit!

What a striking and sorry parallel exists between the story of the luckless godwit and Alaska's caribou, numbering tens today where there were thousands no more than three decades ago!

Next to the jacksnipe, the heaviest toll to the guns was paid by the yellowlegs, plovers, and curlews. A few scattered episodes serve to document the staggering record.

A shipment of nearly 500 yellowlegs went in one day from the marshes at the mouth of the Merrimac to a single game stall in Boston in 1904. A Rhode Island hunter accounted for 1362 yellowlegs in 8 seasons, and another killed 106 at one time by firing into a close-packed flock on the beach.

The big black-bellied plover, the beetlehead of the gunners, was more wise and wary than most of his kinsmen, but that was not enough to save him. He died by the scores before the beach pits and seaweed blinds, and the markets that retailed turnstones and yellowlegs and curlews rated him one of their best birds.

The golden plover kill is hard to believe. In 1821, Audubon spent a day at Lake St. John, near New Orleans, shooting with a party of French gunners. There were 200 hunters in the marsh, strung out in lines of 20 to 50 at promising places. The shooting was continuous from sunrise until after sunset. One hunter killed 750 plover, and Audubon estimated the average take of the 200 guns at 240 birds apiece, a total of 48,000 that fell in one marsh in a single day. And that was an ordinary day, and in March, too, when the spring flight was moving north to the nesting grounds!

So plentiful was the Eskimo curlew that the hunters were not satisfied with a brimming wagonbox, even when sideboards had been added to double the capacity. It was no rare practice, on days when the shooting was good, to dump an entire load of dead birds and leave them to rot in the spring sun, refilling the wagon with a fresh kill.

And when the great flocks were seen no more, the old tales were told as to why the birds had disappeared, the old alibis offered by the men who had wiped them out. Storms had blown the curlews out to sea, they said. Epidemics had overtaken them in the far north. Their summer food supply had failed, and they had perished of hunger. They had changed migration routes and were going north and south by new and undiscovered paths.

The same stories were told of the pigeon. They have been told of every bird that has grown alarmingly scarce or disappeared from the earth. The answer to all of them is the same. They are plain and simple lies, invented by men unwilling to admit their own guilt in the sorry business of wildlife genicide.

No evidence of disease was ever found in the Eskimo curlews, and their arctic pasturelands fruited each summer with lavish profusion. They were strong flyers, and their migration was prolonged from July to September, so that no one gale could have overtaken more than a small fraction of the flight. As for new migration routes, that was the thinnest alibi of all. By the time that tale was spun, the gunners were covering, spring and autumn, every mile of salt marsh and beach and prairie across the continent by which a curlew or any other shorebird could pass between its summer and winter home!

The facts were simple, the story clear. The doughbird had vanished for one reason and one alone. It could no longer run the long gauntlet of the guns across two continents, from the pampas of Argentina to its arctic nesting grounds and back. The smoking guns, both of market hunters and "sportsmen" who had no understanding of the meaning of the word, took a greater toll than the gentle bird could endure!

For that same reason the other shorebirds dwindled from a mighty host to a sorry, ragged company!

Their death was needless and without excuse. They were friends, not foes, of agriculture. For the most part they bred in the far north where vast nesting grounds still await their return. They wintered chiefly south of our limits, in countries where the lack of sporting guns would prevent excessive shooting even today.

They would still be here, the beetleheads and tattlers, the golden plovers and doughbirds, were it not for the spendthrift attitude of an earlier generation. We would still be knowing the pleasure of their presence, in that season when the marshes put on their bronze livery and the morning wind smells of fall, had the need for wildlife protection been understood and respected a few decades sooner.

Will the same thing happen in Alaska? Is the last primitive storehouse of wildlife remaining under the American flag being drained in the same headlong fashion that marked the reckless depletion of the shorebird host? All available evidence indicates an affirmative answer. The alarming decline of many of Alaska's game animals is past denial.

The caribou herds of the interior have all but vanished. Competent wildlife authorities say there are not 500 caribou now in areas that formerly harbored half a million or more. The Dall sheep has dwindled so alarmingly that the Alaska Game Commission gave the species the full protection of a closed season in 1949. The Sitkan blacktail deer have been seriously reduced in numbers. The moose population of the Kenai Peninsula is little more than half what it was fifteen years ago. Even the bald eagle, the bird that holds a proud place as the national emblem of America and enjoys complete protection in the continental United States, is being hunted down in Alaska now under a vicious and indefensible bounty law!

Without exception, Alaskan wildlife authorities agree that excessive shooting, both legal and illegal, is the foremost factor behind the rapid shrinking of the Territory's game supply. Other factors, such as increased wolf predation, admittedly enter in, but they are not the key to the situation. The wildlife treasure house is being emptied largely for lack of adequate funds to enforce the game code and keep harvest in balance with supply. Result: the same type of ruthless and unregulated killing that doomed the shorebirds in an earlier day.

Shall we correct this mistaken policy in time? Shall we reverse the trend of reckless slaughter and inadequate protection before it is too late? Before the roof-of-the-world white sheep has joined the doughbird in extinction? Before the giant moose of the Kenai have shrunk down to a remnant comparable with the tattlers? Before the caribou has gone the way of the golden plover?

The answer rests largely with unselfish conservationists outside Alaska. There are competent game officials in Alaska eager to do the job if they are given the money with which to do it, pleading for a chance, begging Congress for the needed funds. And there are enough Americans who love wildlife, if they will lift their voices in effective unison, to secure for the remaining Alaskan game herds the protection they must have to survive and regain their former plentitude.

The shorebirds stand as a sorry but classic example. The result of unregulated killing and inadequate protection was never proved more clearly and forcibly than in their case. It is not yet too late, in Alaska. But it is later than many realize!

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BOOKS *Continued from page 295*

about human biology. Some of it is undoubtedly oversimplified, but the general impression this book makes is a good one.

Harry L. Shapiro

NATIVE ORCHIDS OF NORTH AMERICA

- - - by Donovan Stewart Correll

Chronica Botanica Co.,
Waltham, Mass., $7.50
400 pp., 148 illusts.

THE popularity of the orchid family of plants among amateur botanists and gardeners makes this specialized work of more general interest to the nature lover than an equally technical book on any other plant family. This popularity is shown by the publication through the years by nontechnical houses of several books describing the orchids of the United States, mainly those of the Northeast. Since the latest, *Our Wild Orchids* by Morris and Eames, was sold off as a remainder some ten years ago, the orchid lover has only been able to obtain information about the native orchids in the pages of a general botany. The appearance of a new work is doubly welcome, not only because it fills a gap in botanical literature, but because it is the first really comprehensive work on North American orchids. The range covered by this work includes Mexican and West Indian species, many of them epiphytic, which did not come within the scope of the earlier works.

The technical appearance of the book is ameliorated by the readable popular discussion of the habitats and growth habits of each variety, which follows the fine-print botanical description. At the end of each of Correll's descriptions he has included, whenever possible, a paragraph of cultural notes by either Dr. E. T. Wherry or J. V. Watkins Transplanting and culturing hardy orchids in the garden is difficult at best; Dr. Wherry's notes should be taken seriously, and the gardener who is unable to supply the requirements as outlined should not undertake it.

The book is well illustrated with sketches of the full plant, the flower, and dissected parts by Gordon Winston Dillon and by Blanche Ames (Mrs. Oakes Ames). It would be difficult to criticize anything specific about the work. Dr. Correll has done an excellent job with the text, and his competent collaborators have each made valuable contributions. While it is in appearance and in fact a technical and specialized botanical work, it is also a book that any plant lover will enjoy, and the wild gardener will find it essential. He may not succeed in his attempts at orchid cultivation, but he owes it to the plants he introduces to learn as much as he can about their requirements before making the attempt.

F. H. Pough

LETTERS

Continued from page 290

Java, since N. Wing Easton remarked that warning signs had been posted at various places in the country where they might be needed to call attention to the danger.

I have seen no recent account of the crater in question, which is on the Dieng Plateau, but presumably it is still in existence. The Dieng volcano is said to have been without an active eruption since 1600 or before, but this does not preclude gaseous emanations. The original account by Loudon mentions an earlier note by a Dr. Horsefield, who said he had heard of the Dieng crater but was unable to persuade the natives to show him where it was. It is easy to imagine their unwillingness to have anything to do with such a place.

Hades in Dominica

A dramatic account of a volcanic valley somewhat similar to the one described above but in the island of Dominica in the West Indies will appear in NATURAL HISTORY in the near future. Do not miss Stuart E. Elliott's "The Mouth of Hell."

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CONSERVATION NEWS

Help for the Vanishing Key Deer

With no more than 32 of the diminutive animals left, word comes none too soon that a meeting was recently held in Key West to explore further the possibilities of a refuge for the animals whose precarious condition was emphasized in an article in the June issue of NATURAL HISTORY Magazine. The survival of this unique little creature is considered doubtful unless at least 200 of the animals can be maintained under natural conditions.

The recent meeting, presided over by Congressman Lantaff of Florida, is reported to have resulted in the settlement of many problems between local people and the U. S. Fish and Wildlife Service.

A bill has been introduced in Congress to provide for the establishment of a refuge for the Key Deer. The bill has been undergoing revision, and readers should urge passage of the amended bill by writing to the House Committee on Merchant Marine and Fisheries, under the Chairmanship of Edward J. Hart of New Jersey. Urge adoption of the bill to protect the Key Deer, HR 2897, and if possible send a copy of your letter to your own Congressman.

Hope for the Sugar Pines

Readers who recall the urgent plea to save the Sugar Pines of Beaver Creek Valley, published in NATURAL HISTORY for February, 1948, may be heartened to know that all is not yet lost. The U. S. Forest Service has indicated that it will take steps to acquire from the Pickering Lumber Company the tract known as Unit 3, which corresponds very closely to the area designated as most urgent in the NATURAL HISTORY article referred to above.

The area that should be preserved extends for about two miles along the southeastern slopes of Beaver Creek Valley and is flanked on the southeast by the South Sequoia Grove. The U. S. Forest Service is offering the Pickering Lumber Company certain other timber in exchange for Unit No. 3 and has pledged to keep this tract inviolate. It promises to allow no trees to be cut on it, so that as funds are contributed for the purpose, this unit can be added to the proposed State Park, which is to embrace the South Calaveras Grove.

The California State Park Commission heartily endorses this exchange.

Citizens aware of the need of preserving the finest Sugar Pines remaining in the world—trees that reach eight feet or more in diameter—are urged to remain vigilant and to lend their support in the formation of a strong public sentiment, which alone can bring these pledges and plans to permanent realization.

Gratification is felt in the realization that it is quite unlikely that as much progress as this could have been made but for Dr. Willard G. Van Name's eloquent plea for the Sugar Pines in the February 1948 issue of NATURAL HISTORY.

THE IDOL OF THE CAVE

Continued from page 318

sharp points, we had the unexpected job of filling in these *dientes de perro* ("teeth of dog"), as they were called by the local Cubanos. When this job was completed, what a thrill it was to ride our horses over the new trail right up to the mouth of the Cueva del Agua!

But now came the real problem—removing the idol—and the more we studied the situation, the worse it looked. Even if we could get the idol loose in one piece, we certainly could not carry it. Yet we did not dare break it up by force for fear of shattering it.

I do not remember who suggested a cross-cut, two-man wood saw. I was doubtful, but we bought an old one from the Mosqueras and tried it on another stalagmite. It worked—slowly, to be sure, but efficiently; and I learned for the first time that a wood saw will cut limestone. It took Gaspar and Cecilio a little over a week to saw the idol off its base and into pieces small enough to carry out of the cave, out of the hole, and up the cliff to La Patana, where they were loaded on our own pack mules. Within a few hours they were at the lighthouse at Cape Maisí.

With no boards available, there was only one answer to the problem of boxes. We sawed boards out from a "cedar" log with an old-fashioned pit saw; and we had the nails. For packing, we used Spanish moss from trees in another locality.

In due time, the schooner that brought supplies for the lighthouse arrived and anchored offshore. Don Ramón, lighthousekeeper, sent a messenger, and I rode down posthaste to make the arrangements. The boxes were carried out in a rowboat to the schooner, which delivered them to the wharf at Baracoa, to await the Norwegian banana ship that would transport them to New York.

Once safely received, the pieces were reassembled; and the idol of Cape Maisí, at long last, was put on exhibition at the Museum of the American Indian, Heye Foundation, where it may still be seen.

Continued from page 303

daydream of burning a man's hayrick by a daydream of saving that man's cow until the whole took on the structure of reality for which he must later become answerable to God, the Bolshevik insists that the outer reality fit his diagnosis of the historical process. Thus he insists that there must be hunger and poverty in capitalist countries and relatively great wealth and prosperity in the Soviet Union. Later the regime maintained this reality by "re-educating" those unfortunate occupation troops who had witnessed the higher standard of living in the "capitalist countries" of Central Europe. The stronger the demand for control grew, the more it generated a fear of the least freedom in themselves or in anyone else, and the stronger the correctives had to become, the more searching the police vigilance.

Now what of the new young Soviet citizens, either those trained for leadership in the Party or the "non-Party" people—schoolboys, soldiers, technicians, writers—who have been reared in an atmosphere where Bolshevik leadership, endlessly suspicious and fearful, was attempting to force on the children of the Soviet Union a new character structure appropriate for a new kind of world. This is what we need to know most, and about it we have only the very scrappiest evidence—from films, from literature, from the defectors among the Soviet occupation troops who fall in love with a German girl and make a break for the American zone.

We know something of how they are reared and how the battle of the regime against swaddling failed, so that the bulk of Soviet children are still swaddled, though probably not as tightly or for as long a period. We know that, although the official literature disapproves of grandparents and extols as ideal a family containing only parents and children, the old country-bred grandparents are still a factor. Under the crowded housing conditions, the large group still exists to accustom a child to the presence and the voices of many persons, as did the communal life of the village. We know that there is official pressure to train children early, to teach them to use their hands, to insist upon punctuality, neatness, order. On the basis of our knowledge of the way human children develop and of the way the old culture fitted together, we may expect that the young Soviet citizen will have some of the traditional fear of his own ungoverned impulses and the corresponding belief in the importance of a strong state authority, reinforced by modern Bolshevik training in the value and importance of control. ("In the Soviet Union," said a recent anti-Soviet DP, "it is impermissible to *think* 'shut-up,' " and this was said in disapproval of the freer ways of modern American children.) We may expect that there will be a strong potential revolt against authority and a corresponding demand for authority, so that young Soviet citizens will dream of throwing off the Soviet yoke, but only in order to establish some other absolute form. We may expect that the training they have been given in accepting a reality that includes not only tractors and machine combines but also a variety of "well-known" dogmas about capitalism and communism, will make it very difficult for them to accept evidence that conflicts with their rigid beliefs. Nor may we expect them to adapt flexibly to the demands of mass production, but they will have an enormous capacity to bring all their energies to bear on any given activity. We may expect this capacity to be dependent upon their belief in the strength and omniscence of the system, a belief that, in turn, will act as a stimulus to the continuance of the control by a secret police system. We may expect everything we do to look different to them from the way it looks to us. For example, in the picketing incident outside the Russian delegation's UN headquarters, last July, the leader of the anti-Soviet pickets "declared the police had been notified in advance . . . and permission to picket had been granted. After the demonstration, he said, police officials had complimented the group on its orderliness." This compliance with American requirements of law and order showed the Soviet Government, however, "that the assemblage of hooligan mobs before the building of the Soviet delegation to the United Nations was known [and therefore, of course, approved!] earlier to the American authorities, because a squad of police arrived at the building of the representatives from fifteen to twenty minutes before the appearance of the above-mentioned group."

In communicating with people who think as differently as this, successful plans either for limited co-operation in the attainment of partial world goals or for active opposition depend upon our getting an accurate estimate of what the Soviet people of today are like. We must know just what the differences in their thinking and feeling are—not because they are basically different from Americans, not because they have one jot less of native intelligence, sensitivity, and potential desire for freedom—, but because they have been reared within a system whose leaders, themselves rebelling against a centuries-old tyranny, incorporated in their new political system a tyranny more effective, more ruthless than the one against which they fought.

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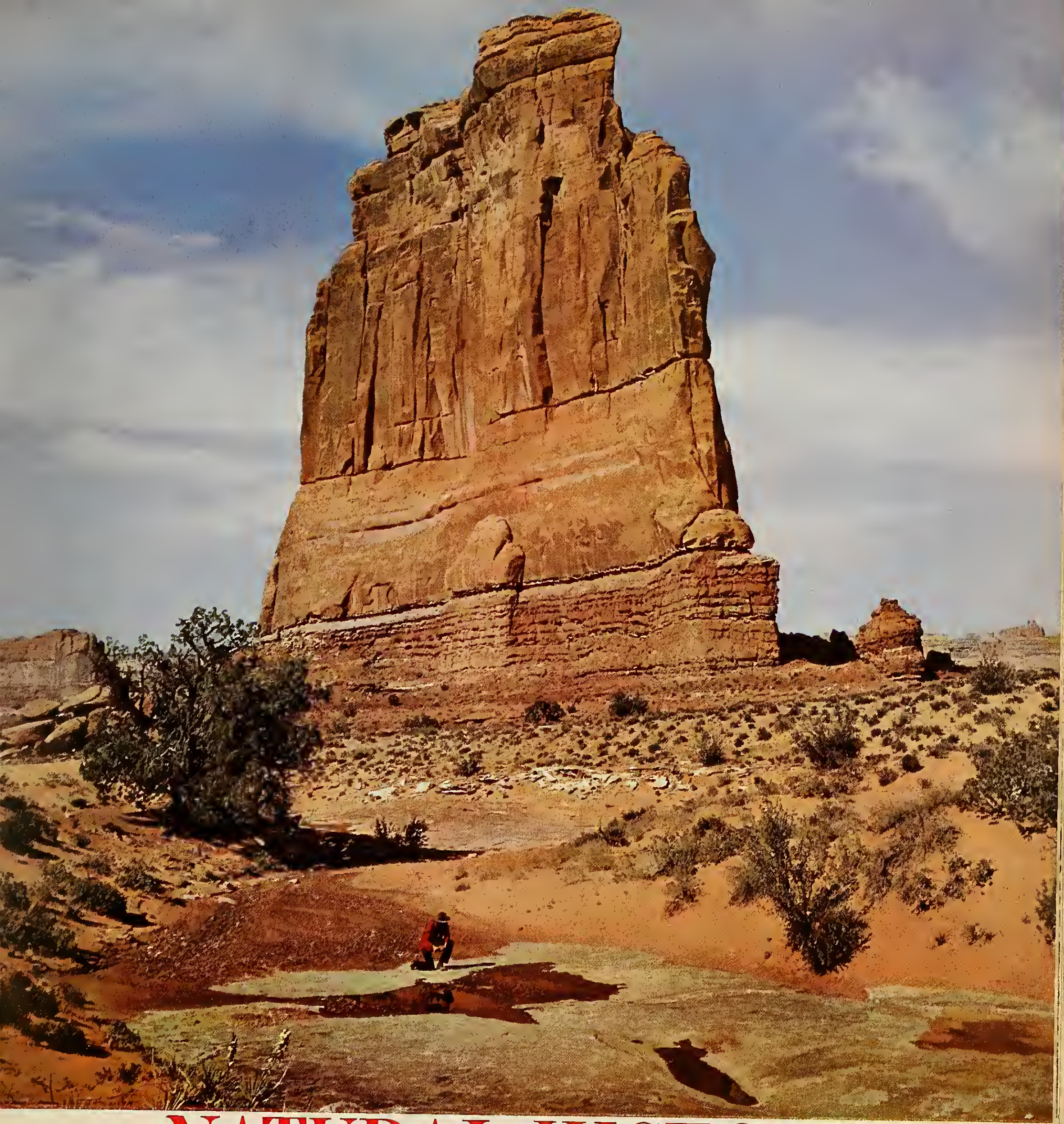

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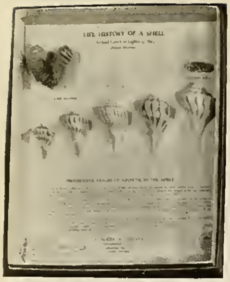
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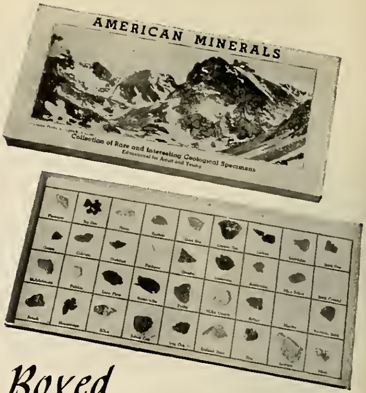
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▲ A WELL-GROWN young Barn Owl in a defensive posture

LETTERS

Bats in the Wall

SIRS:

It occurred to me that you might help us with a problem connected with our Maine cottage in the woods. For the last several summers some bats have located themselves in the space between the shingles and the inside boards on the side of the wall next to the chimney. We cannot remove the shingles without tearing down the chimney. Is there any spray we could use to dislodge these bats?

MRS. MALCOLM MCFAULL
Jackson Heights, N. Y.

The following answer is given by Mr. T. Donald Carter of the American Museum's Department of Mammals:

Bats generally enter the walls of houses from the outside, and they secrete themselves under clapboards, shingles, or inside the walls. You should try to find the hole by which they have entered, and it will probably be easy to recognize, because it will be rimmed with brown. Bats generally conceal themselves during the day and go out at dusk to feed. Mothballs, which bats dislike, can be placed around any likely spots. But the holes should, of course, be stopped up. Until you have gotten rid of the bats and solved the problem so that others cannot enter the wall, you can comfort yourself with the thought that bats are entirely harmless and that they serve man in the most beneficial ways.

How Maternal the Python?

SIRS:

In his book, *Africa, I Presume*, Alan Reeve describes an experience he had in Nairobi. He says: "After dinner with Miller, he led me across the lawn to my bed room, a circular thatched guest hut. As he set a lamp on the table, I pointed to a live python at the head of my bed." The snake was then killed with a stick, and Reeve says, "The python was only a youngster, no longer than three feet. But I slept uneasily that night, expecting a long thick avenging monster of a mother to drop from an overhanging branch and slide through the thatch."

I had supposed that no snake took an interest in or even recognized her young once they were born. Were Mr. Reeve's fears justified?

MRS. GERARD P. HERRICK
New York, N. Y.

The following remarks are offered by Charles M. Bogert, Curator of the American Museum's Department of Amphibians and Reptiles:

Mrs. Herrick is right. The female python evinces no interest in her offspring once they have emerged from the egg. On the other hand, pythons provide some

NOTICE—Readers are encouraged to submit their own photographs of natural history subjects. Those selected for publication on these pages will be paid for at $3.00 each, with full credit to the photographer. Return postage must be included.

▲ **Bazooka:** a most remarkable raccoon belonging to Mr. Emil Liers, the celebrated friend of the otter. Bazooka loves to travel with the otters in the station wagon. During stops to exercise the otters, Bazooka does not climb a tree and make his master waste time coaxing him down. He watches to see when the caravan is ready to drive on and is the first person to get aboard

protection for their eggs, coiling about them for the duration of the period of incubation. The eggs are heaped into a conical mass, around which the female coils, with her head resting on the center. Usually the eggs are completely hidden.

It may be assumed that such behavior serves to protect the eggs from predators. It also serves to prevent the eggs from drying out. And what is of even greater interest, the body temperature of the brooding female is slightly raised while the eggs are being incubated. This heat production in the python is an extraordinary attribute, considering that reptiles ordinarily derive virtually all of their heat from external sources, by basking or by resting on the warm ground surface.

Other reptiles, including such lizards as skinks and the limbless "glass snake," coil about their eggs and remain with them until they hatch. So do some Asiatic pit vipers, which, unlike their American relatives, the copperheads and moccasins, lay eggs instead of giving birth to living young. It is possible that the bushmaster —apparently the only American pit viper that lays eggs—remains on hand to protect the clutch. On rare occasions, men have been attacked by bushmasters without provocation, possibly because the victim happened to wander close to a clutch of incubating eggs.

There is good evidence that the king cobra of southeastern Asia guards its eggs. The late Colonel Frank Wall, an extraordinarily competent student of snakes, states that the brooding female is especially sensitive and usually attacks an intruder on sight. It is uncertain whether she remains in attendance throughout the entire incubation period, but she is undoubtedly present for some time. In some instances, both parents seemingly guard the nest. Few other snakes are quite so aggressive when enraged as the king cobra, which attains the greatest length of any venomous snake, specimens over 18 feet long having been measured.

In Africa, the black mamba has acquired an equally sinister reputation for attacking without provocation, and here again there is some intimation that the female may be protecting her eggs. Natives, not without reason, shun the places believed to be the mamba's "breeding grounds," although it has not been conclusively demonstrated that aggressive mambas are confined to the vicinity of their egg clutches. One mamba is said to have created a reign of terror that lasted for three years in Rhodesia and accounted for eleven human victims. However, such stories are open to considerable doubt. The black mamba may well be the most dangerous snake in Africa, but it can scarcely be so diabolical as depicted.

It is possibly of some significance, nevertheless, that many of the more aggressive snakes, especially the larger species, appear to be protecting their eggs. However, parental care is limited to the eggs. The young evidently scatter to shift for themselves soon after they slit the leathery shell that has encased each of them during their embryonic life. Presumably the female then resumes her routine existence, searching for her own prey and leaving her offspring to do likewise.

And a python would have to be an extraordinarily busy creature to attempt to follow the movements of each member of the brood. The African python in the London Zoo deposited about 100 eggs. Under natural conditions, most of these would have been fertile; and the old woman who lived in a shoe would have had a picnic by comparison!

Man "Bites" Snake

Sirs:

The New York *Herald Tribune* not long ago carried a United Press story about a rattlesnake that bit a man and died. Demetrio Gomez, a civilian employee at Kelly Air Force Base is quoted as having said that the rattler bit him on the leg, had convulsions, and then crawled 15 feet and died. Mr. Gomez himself suffered no ill effects. He explained the snake's death by the fact that, as head of the plating unit at Kelly Base, he handles a great deal of sodium cyanide, which is a deadly poison. "My body is so full of this poison," Mr. Gomez said, "that it has gradually built up a resistance to it, but I guess the snake had not."

Do you think it possible for the rattler to have taken sufficient blood to produce death? If so, how would he get it?

J. M. Hollister

Stowe, Vt.

The following information is offered by Bessie M. Hecht of the American Museum's Department of Amphibians and Reptiles:

Medical men are agreed that no resistance can be built up to sodium cyanide. And when a rattler strikes, the action is a very fast one, no blood being taken up by the fangs. The only blood that could possibly be transferred to the snake would be a small amount that might be left on the fangs if they pierced blood vessels at the instant of the biting. Certainly this amount would not contain enough sodium cyanide to kill the snake. Only if the man had had a tremendous quantity of cyanide in him could this occur, and in that case he would not be alive to tell the tale.

Perhaps if the man's trousers had been completely saturated with the poison, the snake might have gotten enough cyanide in its mouth to cause its quick death. But the fact that the man suffered no ill effects makes it exceedingly doubtful that his flesh was punctured at all. We know of

Continued on page 382

NATURAL HISTORY

The Magazine of the American Museum of Natural History

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In charge of Publications
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VOLUME LX—No. 8
OCTOBER, 1951

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Overnight a "thousand-foot" geyser buried land under mud in Surprise Valley, California

You will find NATURAL HISTORY Magazine *indexed in* Readers' Guide to Periodical Literature *in your library*

THE COVER THIS MONTH

This imposing slab of rock, towering thin as a chisel into the desert blue, is located in Arches National Monument in eastern Utah. Its name is the Great Organ, and it is typical of the gigantic fins, steeples, towers, and spires that make this rocky region famous.

Some day, the forces of erosion may perforate this slab and make of it a natural arch. Most of the 81 arches in the area, however, are in the Windows Section, whereas this rock is in the Courthouse Towers Section. It can be reached by a two-mile walk from monument headquarters, which is five miles by automobile from Moab. The color photograph was taken by Jack Breed.

This fascinating region can be visited conveniently on the way from Monument Valley to Salt Lake City or points east in Colorado. The Monument is open all year.

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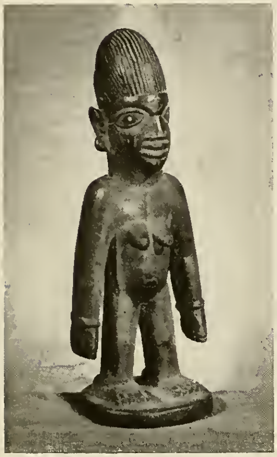
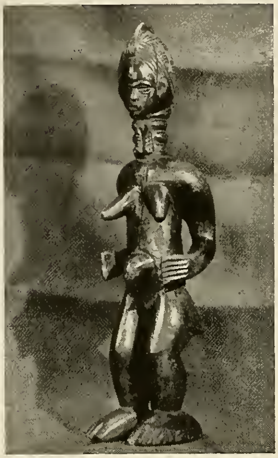


WEST AFRICAN FETISH FIGURE NO. 3

Yoruba, Southern Nigeria. 11 inches high, brown wood. This is an Ibegi figure, kept by a surviving twin to appease the spirit of his dead twin.

$12.50, packing charge 65¢



MENDI STYLE FIGURE NO. 9

Gabun Territory, West Africa. 20 inches high, brown wood. These fetish figures are used by the priestesses of the Tassi Society to receive decisions from the spirits.

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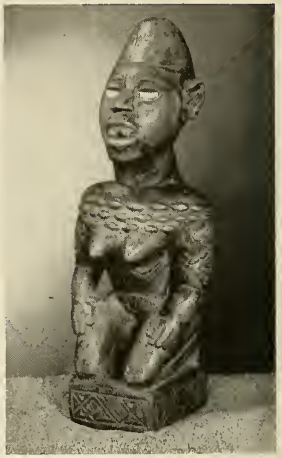
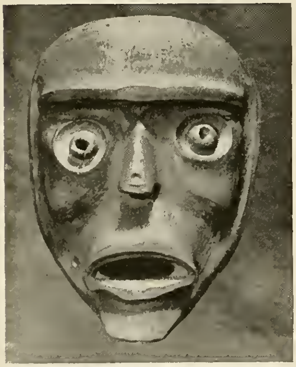


WEST AFRICAN ANCESTRAL FIGURE NO. 4

Bakongo, Western Belgian Congo. 11½ inches high, brown. The Bakongo are noted for their realistic sculptures.

$20.00, packing charge $1.00



NORTHWEST COAST INDIAN NO. 6

Kwakiutl, Vancouver Island. 12 inches high; gray wood. This mask represents a mythical creature called the Paddler in Kwakiutl legends.

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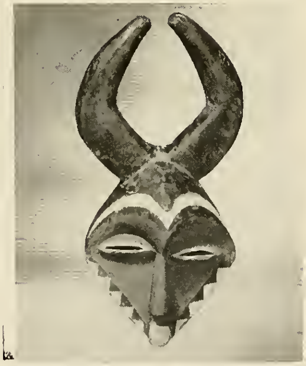

WEST AFRICAN DEITY NO. 1

Bapende, Belgian Congo. 14 inches high; black, white & red. This piece represents a sylvan deity.

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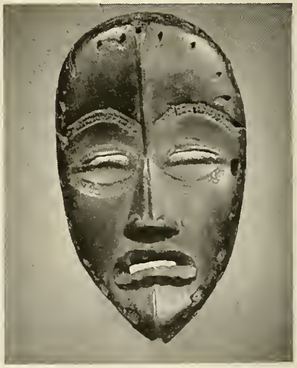

WEST AFRICAN CEREMONIAL MASK NO. 2

Dan, Ivory Coast. 9 inches high, black wood. This mask is used in ceremonies of the secret Poro Society. It is rich in scarification markings.

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YOUR NEW BOOKS

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FORESTS AND MEN

-------by William B. Greeley

Doubleday and Co.,
$3.00, 255 pp.

THIS book is written by one with an almost lifelong connection with the lumber industry. All through its pages one glimpses the view that forests have no other excuse for existence than to be logged off and converted into manufactured products. Yet even to a conservationist, it must be admitted that this is an entertaining and interesting book. It contains a wealth of information, not so much about the forests themselves as about the ways they were used, or more correctly, misused, plundered, and wasted. It tells about the terrible destruction by fire that they have suffered and also about a few of the ways, often entirely illegal, by which private ownership of most of the good timber on the government lands was established.

It tells of the sincere efforts of some of our former presidents (especially those of Theodore Roosevelt) to establish a system of government forest reserves that would bring profit to the nation and avert a future timber famine. But political and commercial domination of the Forest Service, the bureau established to manage these forests, soon put an end to any such hopes. That bureau has not only never shown a profit; it has been a heavy expense to the nation every year. And the magnificent stands of timber that many of the national forests used to contain have been entirely made away with. It is only in a few of the National Parks that a few samples of our splendid primeval forests of immense trees, one of nature's most beautiful and inspiring manifestations, may still be seen. Few people realize how very few and how very small the still existing tracts are.

The serious defect in the book is that it shows only the sunniest side of our forest problem. It does not soft-pedal the dark sides; it just ignores them completely. Its author is overflowing with joy at the infinitely numerous uses for wood that are constantly being discovered. He is not talking about lumber in the form of boards, for the days of boards and of real forestry to produce them are approaching their end, but as wood pulp for paper, cartons, and containers for everything and anything, veneers and plywood, wood fiber and ground-up wood as a constituent of plastics and a thousand other products. We admit that the immediate future looks bright for timber owners just now, but how long can the forests stand the increasing strain?

Few people will agree to the claim of this book that regrowth of our forests is now nearly equaling their destruction. Their area is diminishing in almost every part of the country, and what is more serious, the average size of the trees is smaller. Everywhere all the good land has been or is being taken up for other purposes. It is true that in course of time trees will grow on nearly worthless land, but they are nearly worthless trees and take almost forever to grow.

A short quotation from the book will show the commercial point of view of its author most clearly. "It is only human to deplore the passing of the 'tall whispering pines' . . . But let us not be too hasty in writing off the virgin forest. Every flight across the midwestern states by airplane leaves me with a feeling that the pine forests of the Great Lakes are with us still. The virgin trees have been transmuted into homes, churches, and factories, into solidly built farm houses and barns. The forest has kept right on living with the people . . . The first old trees are gone but the forest is here to stay."

Is it? It does not seem that comment on such sentiments is needed. How many of the millions that annually travel hundreds or often thousands of miles to see and enjoy our National Parks and look at some virgin forest still growing and not yet converted into plywood housing developments will agree with these views? Incidentally, it may be mentioned that, although the book is entitled *Forests and Men,* National Parks, or for that matter parks of any kind, are not alluded to in it.

WILLARD G. VAN NAME

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THE ELK OF NORTH AMERICA

-----------by Olaus J. Murie

The Stackpole Co. and Wildlife Management Institute. $6.50, 376 pp., 62 illusts.

THE elk is one of the finest species of North American mammals and deserving of an impressive book. No one could be better qualified to write such a book than Olaus Murie, for he has the long years of field observation to give him the facts and the broad, tolerant understanding of wildlife relationships to make the best use of these facts.

This big deer has become too well known as elk, an Old World name for the European moose, to justify any attempt to drop the misnomer from current American usage. Hence the author uses this name freely in the book as well as the other name frequently heard, wapiti.

Murie develops his subject in a simple and logical fashion. He touches upon the matter of names, he describes briefly the six distinct forms living today, and then proceeds to develop the life history of the animal. The bulk of the book is devoted to an accurate account of the characteristics of the elk, its habits, its enemies, its diseases, and the pertinent factors that dictate wise elk management. The day is past when this animal could be left as an undisturbed element in a natural environment.

The elk is migratory and requires more territory to live undisturbed than is now available to it. An overabundance of elk plays havoc with the summer range. In some regions the sportsmen do not kill enough animals under normal hunting conditions to keep the elk in balance with their food supply, and there is a very active public sentiment for keeping the numbers as great as possible. The problem has enough irreconcilables to call for the judgment of a Solomon.

Anyone reading this excellent book will appreciate the difficulties involved in satisfying everyone who manifests an interest in the welfare of the elk.

The book is well illustrated. The frontispiece, in color, from a fine painting by Walter A. Weber, is by courtesy of the Frederick C. Walcott Memorial Fund.

HAROLD E. ANTHONY

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THE DINOSAUR BOOK

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Edwin H. Colbert

Curator at the *American Museum of Natural History*

This first McGraw-Hill book in a new series published jointly with the American Museum of Natural History describes in fascinating detail how beasts as big as boxcars lived and fought and died with earth-shaking violence. Dr. Colbert traces the evolution of grass eaters, carnivores, sea serpents and birds, from the earliest geologic ages down to the present. With hundreds of photographs, line drawings and charts; index and glossary. $4.00

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STEVE MATHER OF THE NATIONAL PARKS

--------- by Robert Shankland

Alfred A. Knopf, $4.00, 326 pp.,
25 illusts.

THIS book has a dual interest. Mather, the man, could be worth a book regardless of the field in which he chose to work, and the topic of the National Parks is of perennial interest to every nature lover.

The account of Mather's activity in National Park matters begins several years prior to the establishment of the National Park Service. The reader is prepared for the story of this activity by several chapters of biographical data which bring out the qualifications of the man. He demonstrated in civil life a capacity for accomplishment which later found expression in Federal employment.

During Mather's tenure in the Department of the Interior, nearly fourteen years, the holdings of what is now the National Park Service grew from thirteen parks and eighteen monuments to twenty parks and thirty-two monuments. Beyond this, there was an expansion of the Service's public relationships, which made it recognized as a truly great national factor in conservation. Mather's greatest contribution is undoubtedly his leadership. He guided the concept of Federal protection and administration of parks and monuments from the wilderness of public indifference into the ordered sanctity of a priceless national asset to be jealously guarded. To the many millions of visitors who annually enjoy the areas administered by the National Park Service there can be no question of the desirability of keeping them inviolate, but this national philosophy did not develop overnight. A crusader such as Mather was needed to bring about this chore of mass education.

The story of how all this was accomplished is a very human one. It is packed with incidents that made history, and Mather had associates whose names mean much to all nature lovers.

I have enjoyed this book and consider it the best all-around presentation of the work of the National Park Service and the men who have made it what it is.

HAROLD E. ANTHONY

WILDFLOWERS. HOW TO KNOW AND ENJOY THEM

------ by Samuel H. Gottscho

Dodd, Mead and Co., $2.75
192 pp., 225 photos (103 in color)
48 line drawings

THIS pocket-size book is planned to give the reader the knowledge to identify and enjoy wildflowers. It can be easily carried and consulted by the nature lover who needs an introduction to the plant life of the eastern United States.

The author is a well-known photographer, and the book is planned to get as much as possible from his competence with the camera. The grouping is by color rather than botanical relationships, and for many persons this approach is interesting and effective. He knows his wildflowers, too, so the wedding of art and fact is a happy one.

The forepart of the book gives a general background for its use, sets forth enough botany to explain the terms used, tabulates by seasons the most obvious species and where they will be seen, and comments briefly on the names of flowers and on some of the most prominent plant families.

Then the reader comes to the topic of flower colors, and the basis for the color plates is established. A color chart, ranging through yellow (orange), pink (red), and blue (purple), has associated a few well-known flowers as examples of each shade. The color plates are arranged in separate sections: the blue flower section, the yellow, the white, and the pink flower sections. These sections include pictures of typical environments and a generous supplement of black-and-white photographic half tones.

There is a plea for the conservation of wildflowers, and a list of books on wildflowers, both current titles and those out of print. A few pages on hints for the photography of wildflowers may be taken as coming from an expert.

It is a pity that the publisher has not kept pace with the competence of the author. The color plates were first published by *Woman's Day* and made a pleasing impression upon this reviewer. Perhaps the first run took the bloom from the rose, but regardless of the reason for it, the color plates in this book average poor for color rendition and for detail.

HAROLD E. ANTHONY

BIRDS OF GREENLAND

---- by Finn Salomonsen, Drawings by Gitz-Johansen

Ejnar Munksgaard, Copenhagen,
$9.00, 159 pp., 19 plates

VOLUME II of this handsome monograph is larger than the first part, which was reviewed in NATURAL HISTORY for November, 1950. There is no title page or other front matter, the text beginning with page 159 and continuing through page 348. It covers the life histories of Greenland grouse (several races of a single species, the rock ptarmigan), plovers, snipes, phalaropes and their relatives, skuas or jaegers, gulls, and the arctic tern—in all about 30 distinct forms of birds. This offers a clue to the fullness of the biographical accounts. The one on the ptarmigan alone fills 24 quarto pages of the bilingual (Danish and English) text.

There are 19 plates reproducing Gitz-Johansen's vivid—in some cases almost lurid—watercolors. These, like the illustrations of Volume I, are not likely to appeal to ornithologists schooled in a realism that demands the limning of every feather outline. To the writer of this review, however, they continue to be a welcome departure from a fixed tradition, even if the Danish artist has at times been almost too determined to cling to a starkly primitive idiom. Regardless of any crit-

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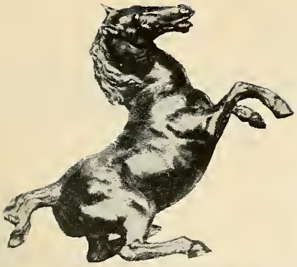

HORSES

THE STORY OF THE HORSE FAMILY IN THE MODERN WORLD AND THROUGH SIXTY MILLION YEARS OF HISTORY

by GEORGE GAYLORD SIMPSON

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Dr. Simpson stresses the animal itself, not its use—an animal that has profoundly influenced man's social and economic development. He has taken the horse as an introduction to the understanding of all animals—classification, the relationships between their structures and ways of life—the meaning of fossils, the principles of evolution.

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Ancient Breeds
American Breeds and their Forerunners
A Horse of Another Color
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Time-Scale of Horse History
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With appendices for places where fossil horses may be seen and for further reading.

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icism that may stem from that fact, his color is pure and the plates convey the needed impression of birds in a stern but glowing arctic environment. The prevailing weakness of bird illustration is that it is wishy-washy—a sin that can never be charged against Gitz-Johansen!

Dr. Salomonsen has written adequate life histories, as thoroughgoing as current information warrants. The seasonal movements, reproduction, and moult of Greenland birds are satisfactorily linked up with what has been learned from experimental studies on the hormone cycle of related species. There are excellent accounts of arctic ecological relationships, including full records of the birds' natural enemies and food organisms. It is surprising to learn that the subsistence of the knot in Greenland is extremely high in vegetable content. As regards food in correlation with season, the author points out that the ptarmigan selects a high-protein diet in spring and early summer but one rich in vegetable oils throughout the months of subzero weather. Nor do the ecological studies exclude the native human bird-hunting population, the "Greenlanders," which seems to be the term invariably applied by Danes to the Eskimo citizens of their democratic kingdom.

Among other bits of interesting biological information are Salomonsen's reports on the strong incubating proclivities of male shore birds. The female purple sandpiper, for example, apparently leaves all such duties to her mate, a fact that forms a behavioristic link between the sandpipers and their relatives, the phalaropes, which have evolved even further in feminine emancipation.

R. C. M.

SEXUAL BEHAVIOR IN PENGUINS

----------- by L. E. Richdale
Univ. of Kansas Press, Lawrence, Kansas.
$5.00, 316 pp., 22 plates,
5 graphs, 1 map

THE title of this book, although much in the current vogue, might be misleading. It is really a scrupulous and quantitative effort to analyze practically every aspect of the behavior of the yellow-eyed penguin of New Zealand. It is fortified, however, by correlative data from other kinds of penguins and a number of sea birds of distinct groups, such as the petrels and albatrosses. Furthermore, earlier research on a wide range of animal behavior has been duly considered. It is only in relation to highly formalized penguin actions that Mr. Richdale has needed to create a new terminology more or less exclusively applicable to the subjects of his investigation. These terms include "sheepish look," "throb," "excited shake," "open-yell," "half trumpet," "kiss-preen," "glare," etc.

Continued on page 384

What are the chances of man not becoming extinct?

FALL OF THE SPARROW

by JAY WILLIAMS

Introduction by
Stanley Edgar Hyman

Darwin wrote about the origin of species; Jay Williams has written about their extinction.

One of the most engaging and witty books ever written on the subject, *Fall of the Sparrow* is the story of why certain species have vanished and why others are threatened. It is also concerned with such intriguing topics as the origin of legendary creatures and the probable end of Man.

During the past 2,000 years, at least 106 species and subspecies of mammals have disappeared from the earth, and untold numbers of other animals are probably now about to say farewell. Mr. Williams describes the sad fate of, among others, such species as the dodo, the sea cow—and the Tasmanians.

What happens when the delicate balance of nature is upset? What are the dangers of over-specialization and over-protection? What have conservation societies been able to accomplish—sometimes in the wrong direction? These are the serious themes underlying Mr. William's entertaining presentation. His answers are clear and incisive, and their impact is staggering.

Fall of the Sparrow is a book that will have special appeal for those interested in wild life. It will prove rewarding for those equally interested in human life.

Illustrated by
RICHARD TAYLOR
$3.00 at all bookstores
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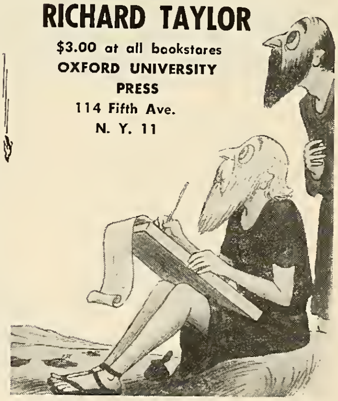
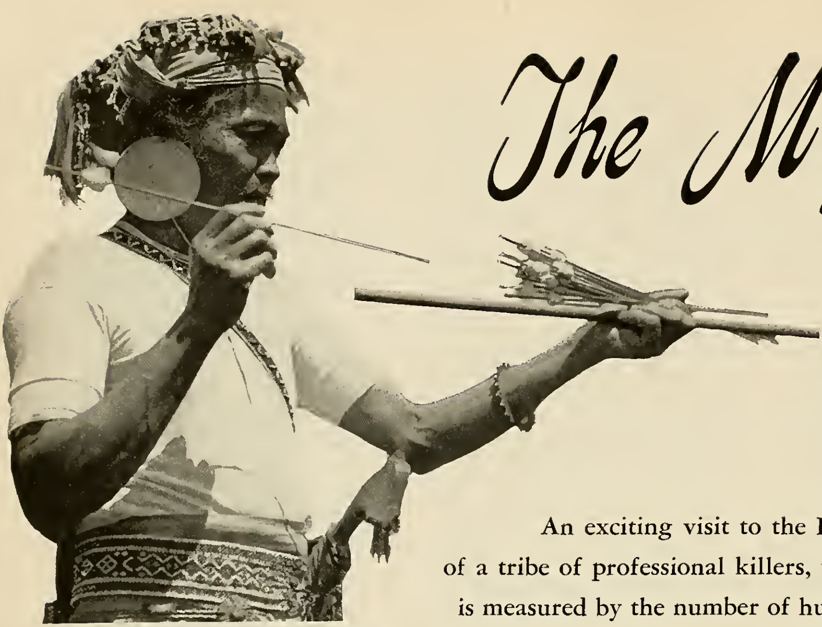


The Mysterious
# of the

An exciting visit to the Philippine Island home of a tribe of professional killers, where a man's prestige is measured by the number of human lives he has taken

By Willard Price

All photographs by the author

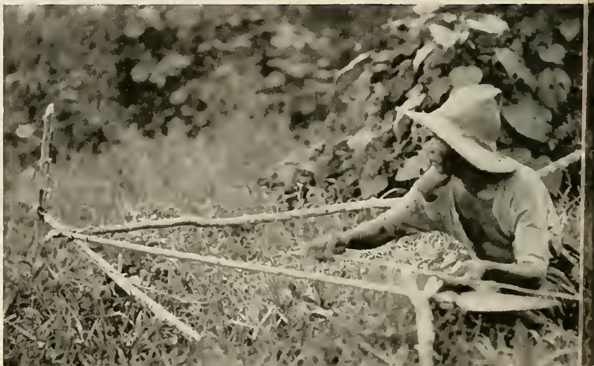


➤ PUTTING A DART into a blowgun. The tuft of cotton fills the bore snugly so that a puff drives the dart a great distance. These darts are sometimes poisoned

THE word "unexplored" was challenging. It was lettered over certain parts of the map of the island on which we now found ourselves. The island was Mindanao, southernmost and second largest of the 3,141 islands of the Philippines, and the time was shortly before the Japanese invasion of that archipelago.

Residents of the port city of Davao told us why these regions were unfamiliar to map makers. They were the home of professional killers. The Bagobos had developed intertribal assassination into an art. Even near the city there were occa-

➤ CATCHING A SONGBIRD. A bird is being tethered to a stick that is wrapped in black gum. Another bird of the same kind will be attracted and caught on the stick. This is a yellow and black bird with a pink bill known as a *soliyo,* which is esteemed as a songster



➤ A MECHANISM for spearing animals. When an animal trips over the cord, a trigger is released, and the spear is driven forward by the bent sapling. This *balatik,* as the implement is called, is now forbidden, because many people were accidentally killed

Land

Bagobos

sional killings, in spite of all that the Philippine Constabulary could do to stop them.

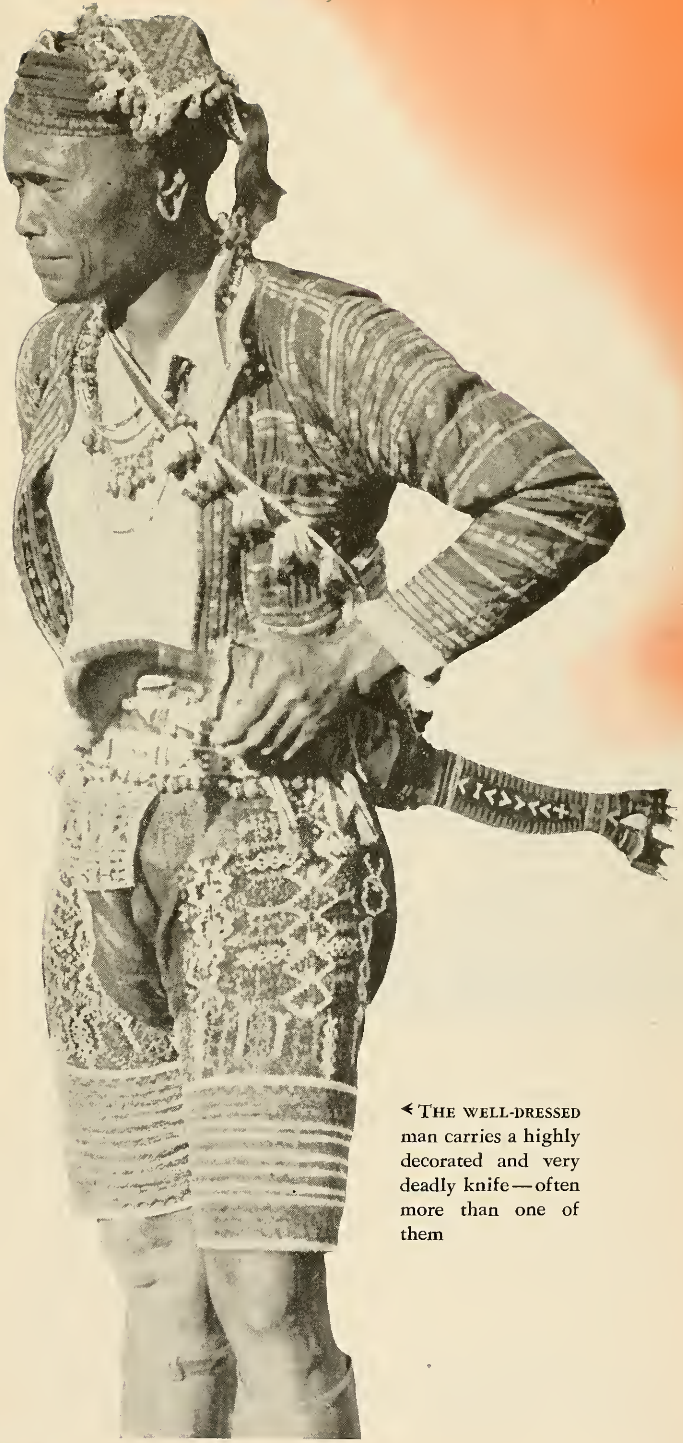
I had long since learned that popular accounts of tribal savagery are likely to be exaggerated. I went to a man who should know—Captain Romulo Dey of the Philippine Constabulary.

"I must go back to Melilla on the edge of the Bagobo country and can take you along if you wish," he said. "There, at least, you will be perfectly safe."

So my wife and I journeyed with the Captain to Melilla, vaguely hoping that when we got that far we might find a way to go farther.

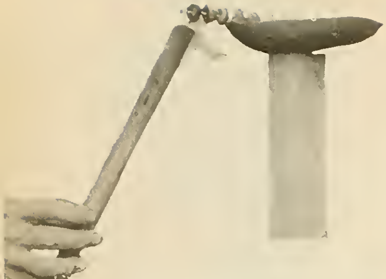
There was nothing ominous about the jungle we passed through. It was not somber and mysterious but well penetrated by sunlight and full of fruit trees. These grew wild, and their fruit belonged to anyone who would pick it. With refreshment all about us, it was not necessary to carry much food. We had only to decide whether we would prefer papayas, guavas, bananas, coconuts, or "the king of fruits," the durian, which has the double distinction of being one of the worst-smelling and best-tasting fruits in the world.

Rising above the other trees were the baletes, which begin as clinging vines and become towering giants. A seed dropped by a bird in the branches of some tree develops into a parasitic vine so small and weak that no self-respecting tree could take it seriously. But the vine grows

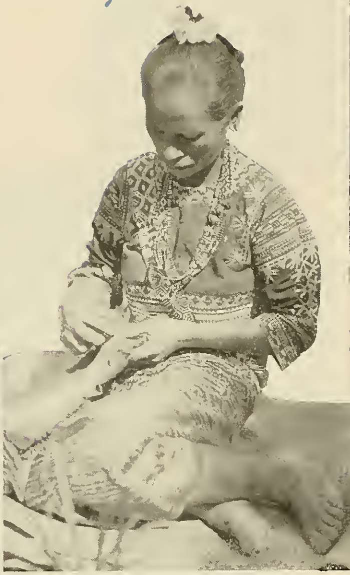


◂ THE WELL-DRESSED man carries a highly decorated and very deadly knife—often more than one of them

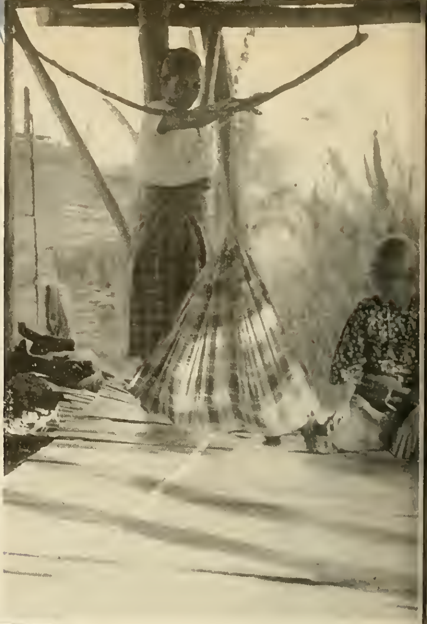
Home life



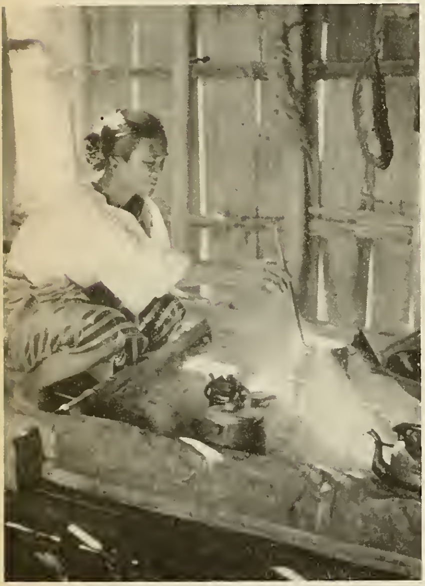
▲ THE "MIDNIGHT OIL" comes from lumbang nuts (candlenuts, in English). Several of the nuts are strung on a sliver of bamboo and laid on a stand. One nut burns down and then lights the next one



▲ THE WOMAN of the house may spend months making one beadwork garment



▲ A CRADLE made of a skirt hun from a bamboo pole. If the child i fretful, the cradle is not rocked bu jiggled up and down



◀ SIX INCHES of dirt serve as a stove, and several fires can be made on it. The walls are of hollow bamboo trunks split and flattened into boards

apace, moving down to root itself in the ground, and up to smother the trunk and all the branches with its powerful ropes and heavy leaves. Its host gradually dies and rots away; and in its place is the vine that has become a tree, perhaps twice as large in height and girth as the original. It rises above nearly all other trees of the Mindanao forest.

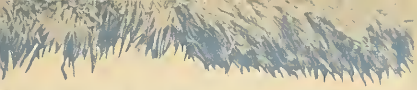
The better part of the day was needed to walk from the nearest motor road back through the woods to Melilla. Finally the Captain stopped and said, "This is it."

We looked about. There was no sign of a house. We stood in a small clearing with nothing but jungle about us.

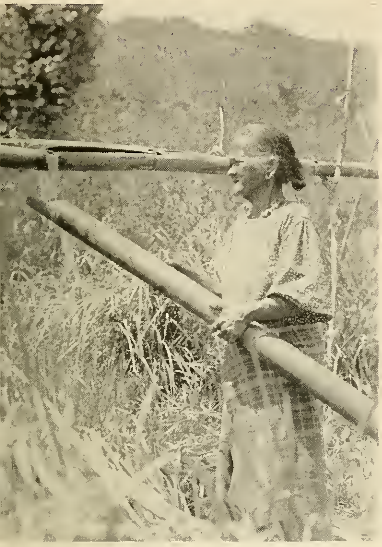
The Captain enjoyed our astonishment. "A Bagobo village is not a village in the ordinary sense," he said. "The Bagobos never put their houses close together on a street. They prefer privacy. Each man conceals his house in the jungle close to his own small fields. And you can never be sure where to find a man's house because, when his little farm is overrun by cogon grass, he abandons it, clears a new spot in the forest, and moves his house."

While we could see no one, others quite evidently saw us, for heads came poking out of the jungle, and we were presently surrounded by the first Bagobos we had seen. They looked as if they had been costumed for a festival. These were no primitive savages but a people with an elaborate though strange culture. They weren't satisfied with loincloths and sunshine; they were fully clothed in brilliantly-colored garments covered with intricate designs in embroidery and mother-of-pearl. Some of the jackets were so completely covered by the iridescent disks that they flashed in the sun like coats of mail. Only a people with remarkable artistic ability and tireless industry could have made them.

Evidently it was the fashion that the teeth must be black and filed to fine points. The lips were red with betel juice. The women wore flowers in their hair, ivory disks in their ears, and strands of beads under their chins. The men wore jacket and breeches and two belts—one for the breeches and the other for an assortment of highly decorated and deadly knives. Bracelets fitted



▼ INSTEAD of a bucket, the Bagobo uses a ength of bamboo closed at one end. The water main is also bamboo



with small brass bells encased their wrists. Their long hair was wound into a coil on top of the head and decorated with tassels and bells. Large ivory disks hung from their ears. They were fragrant with perfume. But any notion that they were softies was dispelled by a single glance at their fierce and sometimes murderous faces.

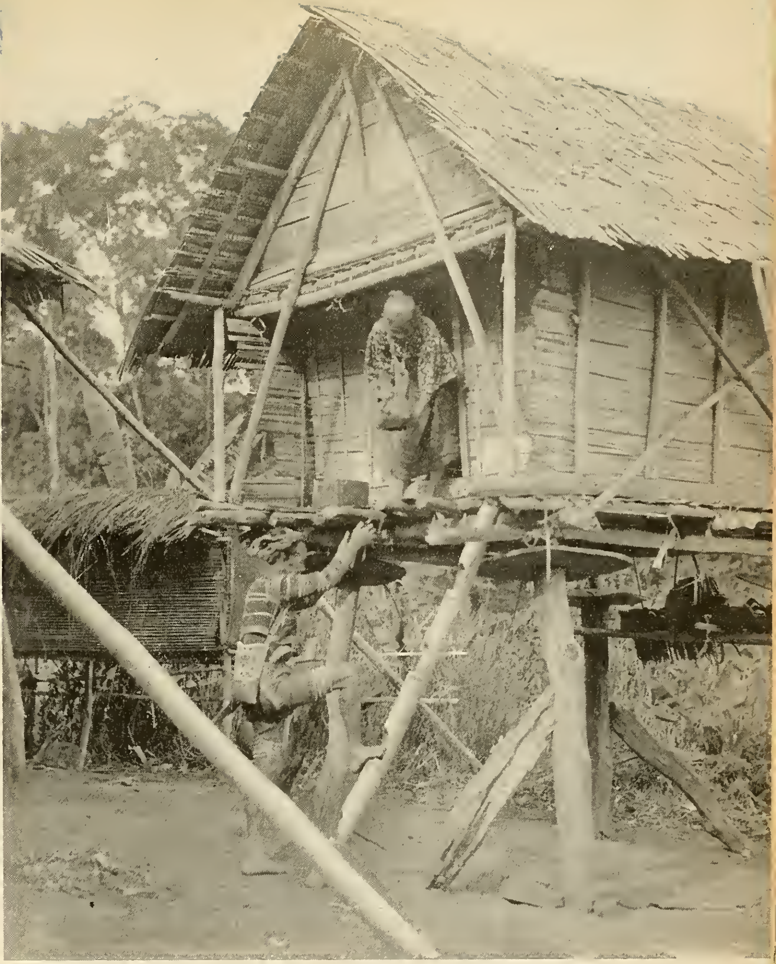
The most disquieting face of all belonged to a big fellow who did not wear the usual multi-colored costume but whose coat, trousers, handbag, and handkerchief were all blood-red.

"He is a magani," Captain Dey told me. I promptly averted my eyes. I had heard of the magani—ritualistic killers – and wished to have nothing to do with them.

But the magani continued to take an uncommonly keen interest in us and presently pushed his way through the crowd to our side. He spoke to Captain Dey in his own tongue, and the Captain translated.

"His name is Ranon. He wants us to go to his house."

"Thank him and tell him that we are otherwise engaged."



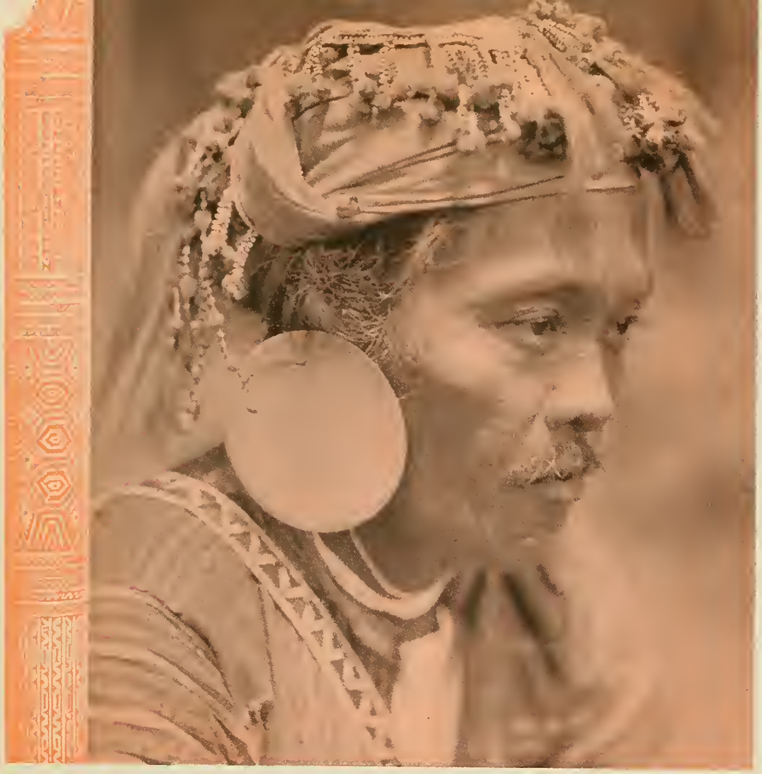
▲ A STORAGE HOUSE for grain and other foods. A notched bamboo pole makes a convenient ladder

"I'm afraid we can't do that. It wouldn't be wise to antagonize him."

We followed Ranon out of the clearing and into the jungle. Presently we came to some posts, and looking upward we saw that they supported a house among the trees fully fifteen feet above the ground. A notched log slanted upward to the front door. Following Ranon, we climbed up this pole, which vibrated precariously under our weight. At night, said the Captain, the pole was drawn up like the drawbridge of a castle, and the house was fairly safe from attack.

We entered the house and found ourselves in a sort of bamboo cage that trembled at every step. The roof was of nipa thatch, and the walls were of bamboo planks seamed with cracks through which the sunlight filtered in. The bamboo floor was also half cracks, so that one had the sensation of walking on air. The Bagobos considered it essential, Captain Dey explained, to have cracks in the floor so that it would be possible to keep an eye out for prowlers underneath the house. The cracks also provided ventilation and allowed escape for smoke from the cooking fire.

The man, woman, and boy who lived in the house were relatives of Ranon, whose own house we were to see later in a remote village.



▲ **Ear ornament of ivory.** The disc has an inner flange an inch and a half in diameter, which fits a hole of that size in the lobe of the man's ear

▼ **Fine strings** of beads hang from ear to ear, where they are attached to plugs inserted in the lobes

We stayed for dinner. It consisted of fresh fish caught in a nearby pool, a delicious paste of banana and sweet potato, and an unexpectedly palatable dish of grasshoppers and rice.

The room was getting dark. I wondered what the Bagobos used for artificial light. There were no electric bulbs, no oil lamps, no candles to be seen.

Our hostess went to a cupboard and took out a sliver of bamboo on which were impaled six nuts. They were candlenuts, rich in oil. The string of nuts was laid in a shallow dish, and the nut at one end was ignited. When it had nearly burned out, the second nut caught fire. The six nuts were good for about three hours of light.

The floor was our chair and the floor was our table, and our fingers were the knives and forks. Ranon leaned toward me with what was supposed to be a kindly grin, but his expression looked inexpressibly evil in the sputtering light of the candlenuts. "In my house I have a table," he said proudly, the Captain translating. "I am a great magani. That is why I wear red."

"Just what is a magani?" I asked.

The Captain undertook to explain. The gods of the Bagobos are jealous gods. They demand sacrifices, and chickens will not do. The sacrifices should be human. A magani is one who kills in order to appease the gods. He does not kill his own people but makes raids on other wild tribes. He may occasionally take a Chinese or Japanese farmer and, more rarely, an American.

"We are trying to stop it," said the Captain, "but we have to work slowly. After all, the Constabulary is not a large force. We are outnumbered many times over by the tribesmen. And we have to show some respect for tribal customs, even though they seem barbarous to us. Ranon has declared that he is done with killing, and we are giving him a chance to prove it. He is, as you might say, on probation."

"What is the significance of the red costume?"

"There are magani of the first, second, third, and fourth degrees. A first-degree magani is one who has taken only three lives. He is not allowed to dress all in red but may wear the red kerchief or *tangcolo* on his head. When he has killed a total of six, he may put on the red coat. After he has killed nine, he is entitled to add the red pantaloons. If the number of victims is ten or more, he may wear black instead of red."

"And since Ranon is all in red that means he stopped at nine?"

"I doubt it. I'll ask him."

He calmly put the question, and Ranon as calmly replied. It seemed unbelievable that a killer would quietly tell a police office how many murders he had committed.

"He says he has killed eleven."

"Then why doesn't he wear black?"

The Captain put the question to Ranon.

"He says that when he began serving his gods he made a vow never to wear black until he had killed fifteen. But he promises he will not try to fill out the quota. He says he likes red. I tell him he had better be content with it or he will be wearing another sort of uniform—in San Ramon Prison at Zamboanga."

It was time to sleep. The flame of the last candlenut was dying out. The night wind gently rocked the bird cage of a house. We lay down with the others, all fully dressed, on the sleeping platform, which extended across one end of the room. The hard wooden bed and the presence of the red killer should have been enough to keep us awake. But thanks to the day's walk, we were asleep in ten minutes.

The next morning I proposed that Captain Dey take us farther into the back country.

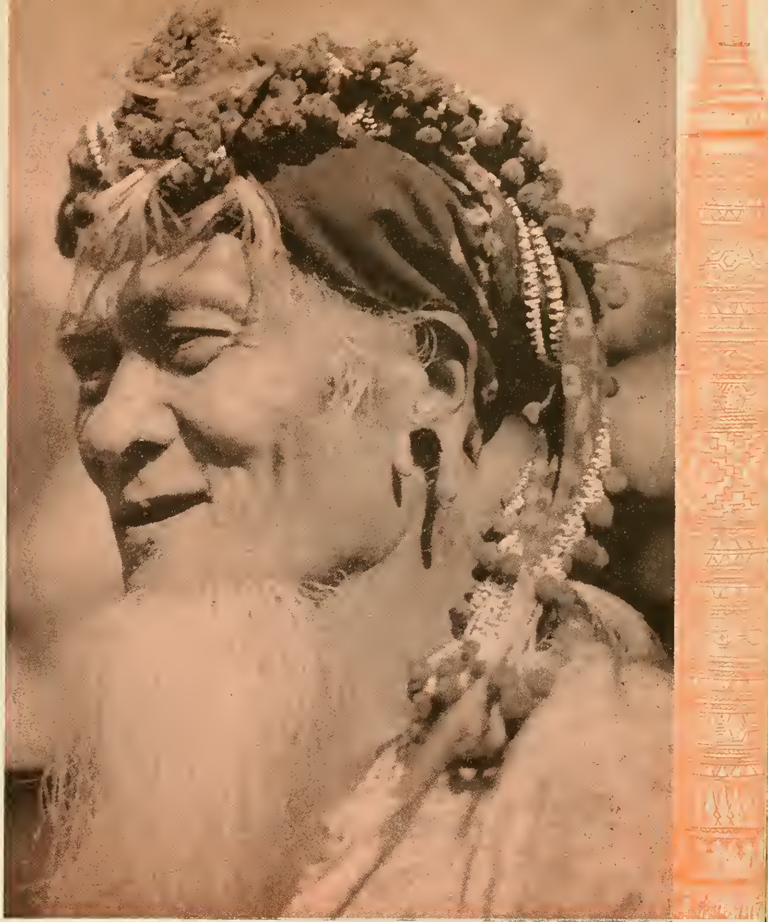
"I'll go with you up to Migdayas," he said finally. "But I've never been beyond that. If you want to go farther, perhaps Ranon will guide you."

The suggestion was rather distasteful. We had hoped to leave Ranon in Melilla, but he insisted upon accompanying us.

Ranon soon proved useful. He saved my life from the deadly poisoned spear of the *balatik*, a contrivance that releases a weapon when an animal in the path trips on a vine which has been rigged as a trigger. He warned us of leaf-covered pits, at the bottom of which were sharpened bamboo stakes to kill any animal that might fall in. It was necessary also to watch for a "deadfall," a heavy log so arranged that it would drop on anything passing beneath. Ranon warned my wife in time to avoid putting her hand on a dangling snake which looked like a heavy vine. He slashed a large vine, the rattan, with his bolo, and we drank the cool water that welled out of it.

The trail was very steep and hard, and even Ranon's assurance that we were the first Americans to travel it did not make it any easier. We were climbing from the coastal lands toward a high ridge. There were no more fruit trees. Instead we passed great apitongs and lauans nearly 200 feet tall. Big dapdap trees covered the ground with crimson petals. Now and then we saw a heron, startingly white against the shadows of the forest. There were dozens of other birds. Most of them had deep resonant voices quite different from the soprano of birds of temperate climes.

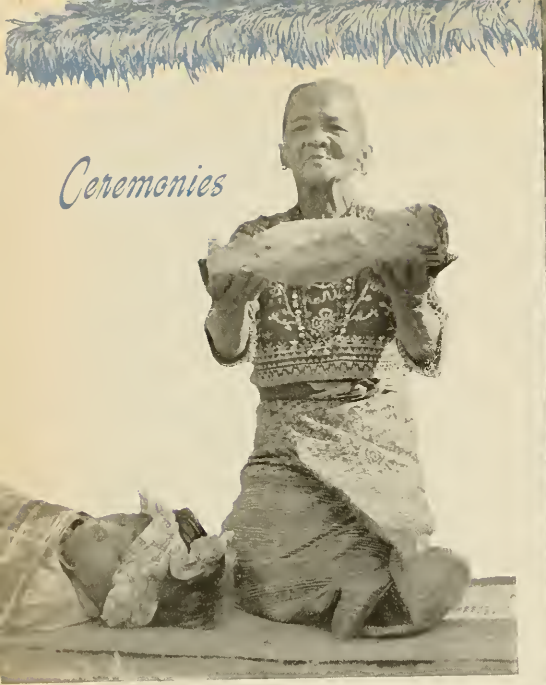
A little before sunset we came out on the ridge with a good view of Mt. Apo, lazy smoke rising from



➤ A venerable Bagobo

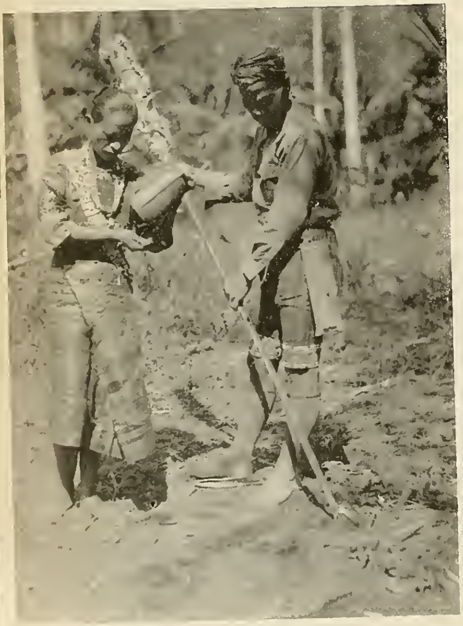
▲ Old men, lacking teeth, pound the hard betel nut in a mortar of silver inlaid with brass. The costume is elaborately beaded

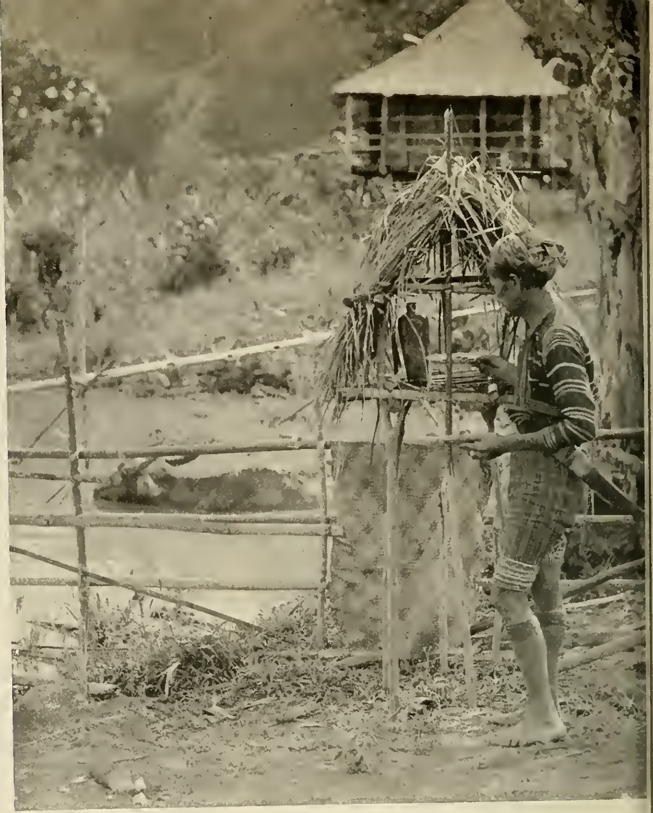
Ceremonies



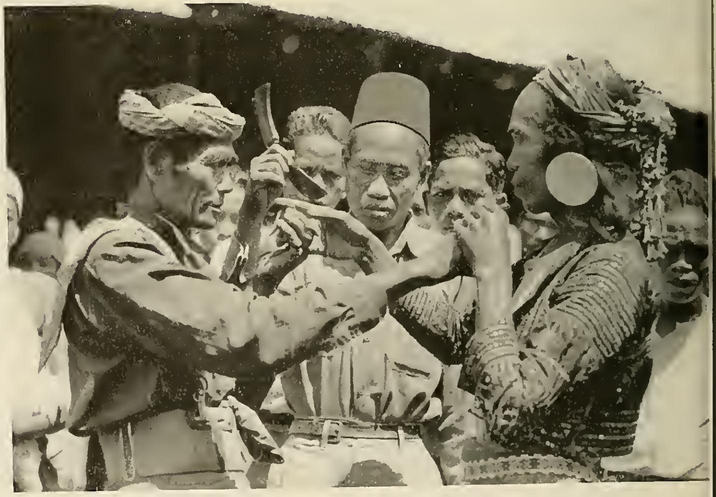
▲ A sorceress, or *mabalian,* is offering the spirits a roughly carved doll in place of the boy whom they have made sick

▼ The man goes down the field using the *palakpak* to turn up the soil, and the woman follows, sowing the seed. At the upper end of the *palakpak* is a bamboo clapper, which makes a loud sound every time a hole is dug, thus pleasing the spirit guarding the field





▲ Because a girl in the house is ill, offerings are placed on this roofed stand, or *tambara*—betel nut, bananas, and a bottle of water



▲ The blood compact. This ceremony is performed by men of different tribes, as when a Moro comes to live among the Bagobos. The Moro *(left)* and the Bagobo *(right)* suck each other's blood after the *datu,* or chief, has cut their fingers its sulphur-coated crater, and Ranon announced that we were in the village of Migdayas. He took us to the house of the *datu,* chief. Ranon spoke to him in a patronizing way, for this *datu* was just a first-degree magani, having taken only five lives.

The inside walls of his house were hung with weapons of the chase and weapons of war: spears, knives, bows, and blowguns. Across one end of the room was the sleeping platform, raised about a foot from the rest of the floor. Food was stored in baskets hung from the rafters to keep it away from ants, rats, and snakes. There was a loom for turning hemp from the abaca plant into clothing. Moderns who want all the new gadgets might have envied the *datu* his dishwashing machine. It was simply a bamboo cage outside of the window. You put all your dirty dishes in it, and the daily rain washed them clean.

In front of the house was a *tambara,* a pedestal bearing a dish of fruit as an offering to the spirits. Every Bagobo house had one. The Bagobos are animists and live in constant dread of the spirit world.

Captain Dey had to turn back; he had duties in Davao. "Will you go back with me, or do you want to continue with Ranon? He has offered to take you on a week's journey through the hills. Then he will bring you out at Malagos. That is where he lives. I'll have another Constabulary officer meet you there."

If Captain Dey thought this was a fit and proper arrangement, who were we to question it? We followed the man in red into the hills. The truth is, we were beginning to like him. He always seemed to know the right thing to do in an emergency. In every village he was respectfully and somewhat timidly received, and even the *datus* took his orders. Although he could not speak any language we could understand, he taught us much about the life of the Bagobos. Captain Dey had told him of our curiosity concerning tribal customs, and he took pains to stage demonstrations so that we might see these customs for ourselves.

We saw how a Bagobo wedding was conducted. It was easier than marriage at Gretna Green or Las Vegas. The bride and groom sit on a mat facing each other. Each feeds the other a handful of rice. They bump their heads together and are man and wife.

The groom pays the bride's father one copper gong, one horse, and a betel box. But the bride's mother, in turn, presents the groom with one copper gong for himself and ten skirts for his wife.

A man may take as many wives as he wants and can afford, but he may not take a second until the first has borne a child or has proved to be barren. For every additional wife brought into the family, the husband must pay his first wife a substantial sum. Thus the first wife usually does not object to the advent of new wives, provided they recognize her as the lady of the house and obey her.

Divorce is easy. A plate is broken to signify that the marriage is ended.

We were shown how the teeth are filed to sharp points and how they are blackened with a deposit of charred bamboo. An ear-piercing ceremony was staged for our camera. A hole is made in the ear, into which a tightly coiled coconut leaf is introduced. The constant expansion of the springlike leaf makes the hole larger and larger until a package of cigarettes can be carried in it, or a small parcel. One *datu* wore ivory discs four inches in diameter in his ears.

We saw the process of tattooing: the skin is cut with a knife, and the ashes of resin from the lauan tree are rubbed into the cuts.

A remarkable ceremony is the

Continued on page 383

▼ **THIS TAMBARA,** which is placed upright in the ground, supports a dish filled with fruits or grains as an offering to the spirits

▼ **BAGOBO WEDDING.** Two portions of rice are laid on a banana leaf in a winnowing basket. Each gives the other a bit of rice, then they bump their heads together and are married

The MURDER of a Landscape

Shortsighted exploitation poisoned and denuded the hills, and 100 square miles of southern countryside have become an almost hopeless desert

By Edwin Way Teale

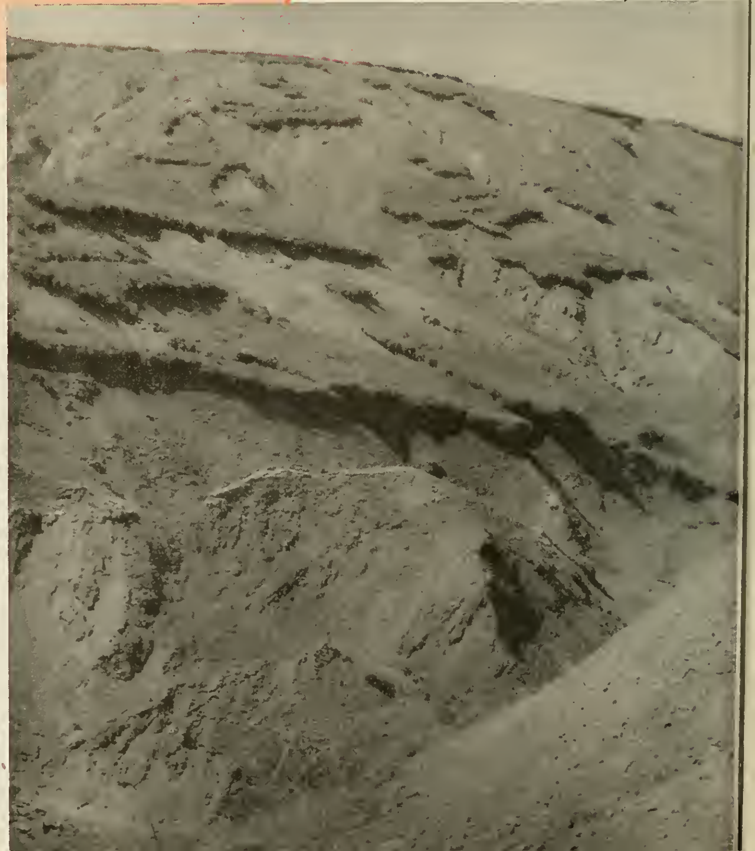
ALL that morning, in the April sunshine, our road had carried us through mountain forests, green and lush. Then, like a pleasant dream sliding into a nightmare, the country swiftly changed.

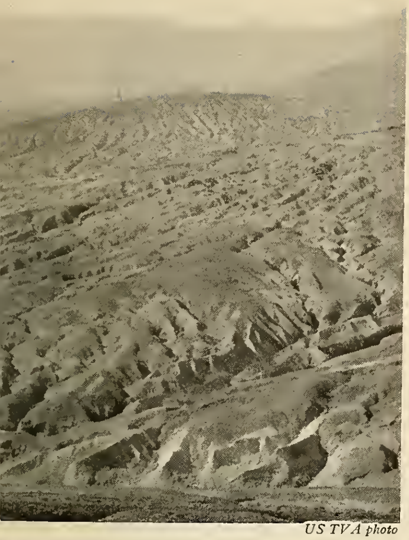
The forest thinned away. The trees grew smaller, became stunted, disappeared altogether. Bushes shrank and vanished. Grasses died away. Blighted land replaced the forest. All around us, dead hills, red, raw, ribbed by erosion, stood stark in the sunshine. Hardly two miles from dense woodland, we were in the midst of a moonscape on earth. Ahead of us, the road led through a land of desolation, through a man-made desert, through a hundred square miles of poisoned earth.

We were in the southeast corner of Tennessee, in the Ducktown Desert of the Copper Basin. Chattanooga lay 70 miles to the west behind us, Gatlinburg and the Great Smoky Mountains, more than 100 miles to the north and east along the Tennessee-North Carolina line. The Ducktown Desert occu-

▼ A WOUND THAT REFUSES TO HEAL. The protective vegetation has been broken, and the hills are being washed away

Edwin Way Teale photo





US TVA photo

▲ **In the midst of lush mountain forests, the Ducktown Desert shows only scattered patches of grass. Erosion has begun and will continue unless plant cover can be re-established to hold the soil in place**

pies a position where three states, Tennessee, North Carolina, and Georgia, join. The boundaries of the three commonwealths meet near an old church on a desolate elevation, which bears the ironical name of Pleasant Hill.

All the hills were pleasant here less than a hundred years ago. What had happened? What had left these slopes around us sterile and almost lifeless? What had produced this desert in the midst of a green landscape? We pulled in for gasoline at a filling station, perched like an oasis on a barren hilltop. Our questions were an old story to the proprietor. Ten thousand times a year he had heard them. Bewildered tourists had interrogated him so often he had had a pamphlet printed in self-defense. From it and from other sources, we learned the history of this tragic area. It is a classic tale of land abuse. It is also, in its way, a murder story. For it deals, literally, with the murder of a countryside.

Until about 1840, Cherokee Indians occupied the land. Hardwood forests clothed the hills, and shaded brooks meandered toward the Ocoee River. Then General Winfield Scott, carrying out orders, rounded up the Indians and herded them west. White settlers moved in. Not far from the village of Ducktown, copper ore was unearthed and a scramble of fortune hunters began. The village boomed. It was, at one time, more prominent than either Knoxville or Chattanooga. It had a newspaper, *The Ducktown Eagle,* before the Civil War. During the war between the states, copper from Ducktown played an important part in keeping Confederate armies in the field.

At first, ore was hoisted to the surface with a hand-operated windlass, and the bellows of the smelting furnaces were powered by old-fashioned water wheels. The refined metal was packed on mules 70 miles to the railroad at Dalton, Georgia. By 1853, however, gangs of laborers had cut a road through the Ocoee Gorge to the west, and, for decades thereafter, iron-shod wheels of heavy wagons rolled behind straining horses to carry copper 40 miles to the railroad at Cleveland, Tennessee. We had followed the same route, now U. S. Highway 64, that morning as we passed through the Cherokee National Forest.

It was a custom, in the early days of copper mining, to roast the ore under large log fires before placing it in the furnace. This eliminated the sulphur. As the Ducktown area developed, the demand for wood mounted. One company alone consumed 20,000 cords of wood and 500,000 bushels of charcoal annually. Convict labor was pressed into service chopping wood. Axes rang all day long. The forests receded in an expanding circle. At the same time, the flaming piles of wood, sending up their

▼ **Near the outer edges, cows graze on rapidly shrinking pastures**

Edwin Way Teale Photo

showers of sparks night and day, ignited the surrounding grass and bushes. Behind the receding forests, in times of dry weather, almost daily fires swept the earth bare of vegetation. Always it came back. But always it was consumed again.

Even worse than ax or fire, however, was a third enemy of the vegetation. This was the clouds of sulphur dioxide gas that rose from the roasting piles and hung in a noxious pall over the hills of the Copper Basin. It attacked the grass and plants and bushes that remained. It damaged the breathing pores of the leaves. Evergreen needles became brown. Leaves on deciduous trees turned white, red, red-brown, or yellow. Growth rings in the trunks of the dying trees became thinner with each succeeding year.

Different kinds of vegetation respond in different ways to the poison of this gas. Blue violets, for example, when enveloped in sulphur dioxide, lose their blue and turn green. Larch trees are highly susceptible to the fumes in spring but more resistant in fall. Hemlocks, white pines, and sycamores are easily killed by the gas; red maples, white oaks, and black gums are more resistant to it. On still days, when there is fog or high humidity, the damage is greatest. Vegetation on hillsides facing the roast yards and smelters of the

Edwin Way Teale photo

▲ WATER IS NOT LACKING in this desert. The topsoil is gone, and nothing will take root on the steep slopes. Clear evidence that in land care an ounce of prevention is worth a pound of cure

▼ THE GRAND CANYON probably looked like this in its infancy. Unless checked by plantings or by nature's slow repair, the destruction will continue as long as water runs downhill

US TVA photo

▼ DOWNSTREAM, where the slope is more gradual, silt is deposited. Poor conservation practices are often costly far beyond the areas directly affected. The Ducktown Desert is causing dams to silt up

US TVA photo

Copper Basin was first affected by the fumes.

In addition to attacking the growing plants, the sulphur dioxide entered the soil, either directly or by absorption or indirectly by atmospheric precipitation or through absorption by vegetation. This tended to increase the acidity of the soil.

By the end of the roast-yard era, that is, about the turn of the century, all the trees were gone from the region, and all the lower forms of vegetation were going. The hardy sedge grass, which had withstood the attack longest, was giving way before the endless burnings. The protecting skin of the earth, vegetation, was being sloughed away. Patches of bare soil expanded. Those twin instruments of erosion–the chisel of the rain and the hammer of the wind–did the rest. The climatic extremes and the heavy Appalachian rainfall of the region speeded the destruction. Swiftly the fertile topsoil slipped away down Potato Creek, down Bushy Creek; millions of tons of it washed away as silt down the Ocoee and the Tennessee, down the Ohio and the Mississippi. Left behind, like a red-flayed carcass, were the raw hills of sterile undersoil.

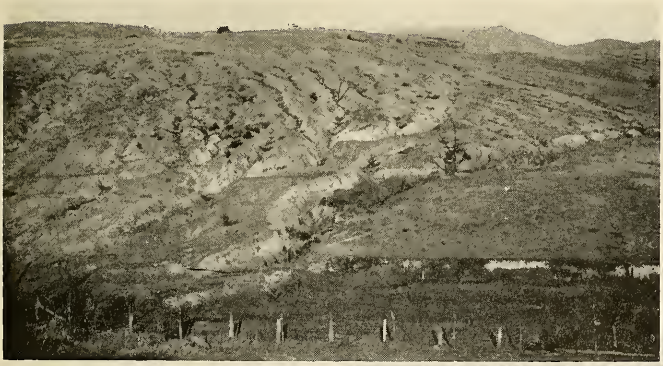
They rose around us as far as we could see. They formed a nightmare region, symbolical of all the erosion-ridden fields, all the dust bowls man has created on this continent. Only a few minutes before, we had stopped by a mountain spring amid woods to listen to a hooded warbler sing high in a yellow birch. Small birds had been everywhere. The forest edge along the roadside had swarmed with them. There, life was at an exuberant peak. Here, it seemed almost entirely absent. We heard the far-away jingling song of a field sparrow on one of the patches of sod that still clung to an eroding hillside. We saw three English sparrows picking on the bare ground before a clapboard house that huddled disconsolately on a treeless plain, its roof tinted pink by dust from the desert hills. But we saw, in all that accursed red land, only one wild songbird among the many millions then migrating north.

This bird was drinking from a small streamlet of clear water that flowed down the groove of a deep gully. Even there, where water was plentiful, the sterile soil supported hardly a single plant. Beside the rill, bending down, then lifting its head high as it drank, was a white-throated sparrow. Its crown was brilliantly streaked, its throat patch snowy, the yellow before its eye vivid in the intense sunlight. In this bleak setting, this migrant, pausing on its journey to damp, mossy, shaded northern woods, looked incomparably beautiful.

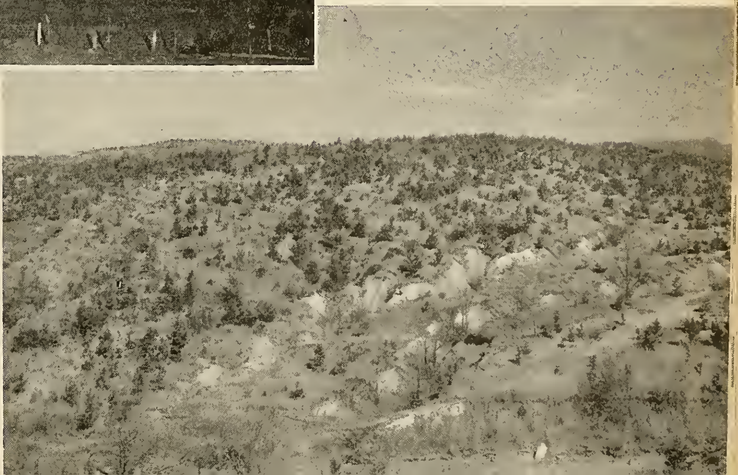
Near the edge of the desert, where the patches of sedge grass were larger, half a dozen cows wandered about, feeding as best they could on the sparse pasturage of these shrinking islands in a sea of

US TVA photos

▲ CCC PLANTING CREW. Many grasses and trees have been tested



▲ AN AREA in which reclamation work had been begun in November, 1941. Prior to planting, check dams are built in gullies and straw mulch is spread



➤ THE SAME AREA six years later. Definite progress is noted, but the work is expensive and slow. Most of the area remains a desert. As yet, man has not been able to undo the damage he has done erosion. A few meadowlarks, I was told, still return to nest on these patches that hang like pieces of sloughing skin to the hillsides. During the time nestlings are being fed, the larks fly from patch to patch, as though among the islands of an archipelago, in their search for insects.

But insects, like other forms of life, are scarce in the Ducktown Desert. We saw a few small blue butterflies, azures of spring, drifting along the roadside. And once, when we stopped on a hilltop to view the dead landscape around us, we discovered minute red ants swarming over the red soil. They were racing wildly, bumping into each other, milling about a small dead caterpillar a few inches from the anthill. Here was a great prize in this austere land. Never have I seen ants of a similar size running with greater speed. The untempered glare of the sun beat down upon them. Its heat shifted them into high gear.

I laid down a thermometer beside the anthill. Its mercury slid swiftly upward until it touched the 115-degree mark. What would a midsummer reading be? Without the balance wheel of vegetation, the bare hills of the Copper Basin heat up rapidly under the sun and cool off just as rapidly with the coming of night. Between midafternoon and night on a September day, the thermometer may fall as much as 35 degrees.

In other ways, the disappearance of vegetation has modified the local climate in these badlands of the South. During summer months, for example, the heat is usually greater at the eastern edge than at the western edge of the area. The prevailing winds are from the northwest. They flow across the vast griddle of bare ground and are heated as they go. Moisture in this red soil also evaporates at an abnormally rapid rate. When scientists of the U. S. Forest Service made tests, they found that evaporation on the naked hills was five times as great as on the floor of the neighboring forest–as long as the moisture lasted.

As we drove past the great smelter of the Tennessee Copper Company at Copperhill in the heart of the Ducktown Desert, we looked up and saw lofty stacks discharging their fumes high in the air above us. After years of litigation, the U. S. Supreme Court, about 1907, ruled that the copper companies of the area were responsible for controlling the sulphur dioxide they had been pouring into the air. In consequence, special equipment was installed to recover sulphuric acid from the smelter smoke. The result is that, today, the Copper Basin is the largest producer of sulphuric acid east of the Mississippi. To aid in dispersing what fumes remain in the smoke away from the immediate neighborhood, higher smokestacks were also built. One of the stacks that towered above us was 400 feet high!

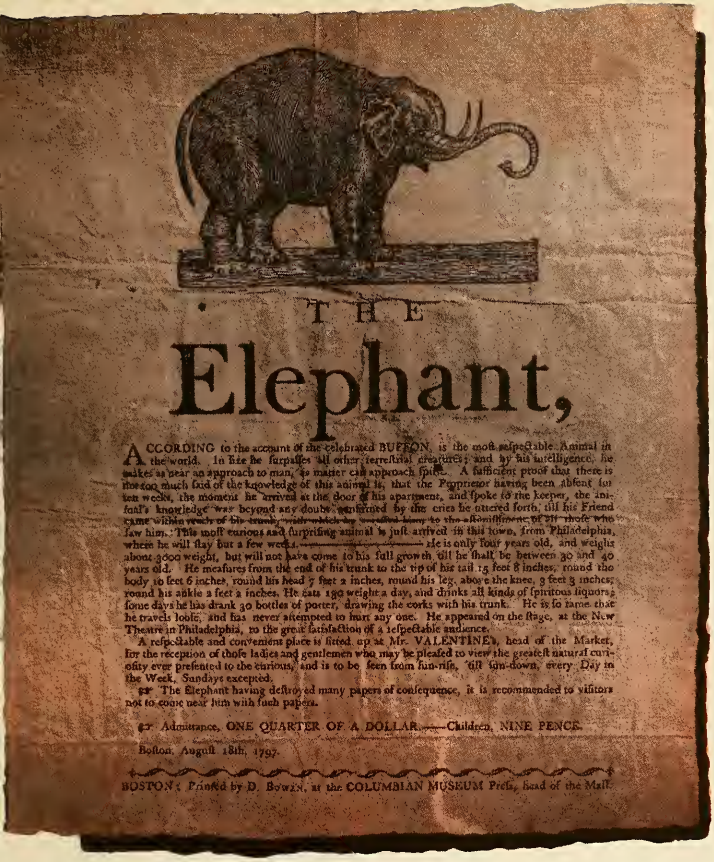
Sulphuric acid—which played such an important part in the destruction of plant life here and was wasted for so many years—is now one of the strategic materials of which we are critically short. So it would have been good conservation for more than one reason to have reclaimed it from the start. We have not yet learned the lesson of Ducktown. Hundreds of factories all over the United States are still discharging noxious materials into the air that could be reclaimed at an eventual profit.

Can the Ducktown Desert ever come back? Can this moonscape ever be made fertile again? Extensive researches were carried out in the area before the Second World War by the TVA and the Tennessee Copper Company. The Tennessee Valley Authority was concerned because erosion among the naked hills threatened a rapid silting up of some of its dams. Under the direction of the Civilian Conservation Corps, hundreds of thousands of trees were planted. Check dams, formed of brush and hogwire, were set up in the gullies. Hilltops were mulched to retain moisture and prevent runoff. From Africa, Japan, the Mediterranean countries, plants were brought to Tennessee and tested as cover for the poisoned hills.

In nearly a hundred different plots, scattered over the area, the scientists tried out plants with strange names and remote origins—kudzu, Sudan grass, trailing Lespedeza, Italian rye grass, crown vetch, Bermuda grass, bird's-foot deervetch, Bahia grass of the Pensacola strain. And, one by one, the research scientists crossed them off the list. A single plant, *Eragrostis curvula,* or Weeping Lovegrass, a native of South Africa, proved useful in the completely denuded areas. Of the innumerable trees tested, two kinds, both native to the region, proved best. Black locust showed itself most effective in the gullies and pitch pine on the eroded hillsides.

Before World War II virtually brought to a halt efforts at reforestation, more than 2,400,000 trees had been set out. We looked around us. A few small clumps of pines huddled together amid the waste. These were the trees that had survived—an almost negligible number. The vast majority had succumbed to the insurmountable conditions of life in this desert produced by man. So far, man has failed to undo the damage he has done. The problem remains unsolved. Unless more effective aid is forthcoming from man, the desert has only the long hope of Nature's slow repair.

We drove on through this land no spring could awaken. Here no showers could stimulate probing roots and rising stems. Here no sun could contribute to the production of chlorophyll. The hills were stricken, and the land lay dead. But as we drove on, grasslands reappeared. Small trees, at first widely scattered, grew more numerous. They gained in size. Then we were in woodland once more, the desert left behind. All the lushness of spring surrounded us as we climbed on winding roads through mountain country to the east. But in our mind's eye, all the way and during the days that followed, we saw the bare ribs of the earth, that strange, dead, red earth, that spreads away over the poisoned hills of the Ducktown Desert.



T H E

Elephant,

ACCORDING to the account of the celebrated BUFFON, is the moſt reſpectable Animal in the world. In ſize he ſurpaſſes all other terreſtrial creatures; and by his intelligence, he makes as near an approach to man, as matter can approach ſpirit. A ſufficient proof that there is not too much ſaid of the knowledge of this animal is, that the Proprietor having been abſent for ten weeks, the moment he arrived at the door of his apartment, and ſpoke to the keeper, the animal's knowledge was beyond any doubt confirmed by the cries he uttered forth, till his Friend came within reach of his trunk, with which he careſſed him, to the aſtoniſhment of all thoſe who ſaw him. This moſt curious and ſurpriſing animal is juſt arrived in this town, from Philadelphia, where he will ſtay but a few weeks.——He is only four years old, and weighs about 3000 weight, but will not have come to his full growth till he ſhall be between 30 and 40 years old. He meaſures from the end of his trunk to the tip of his tail 15 feet 8 inches, round the body 10 feet 6 inches, round his head 7 feet 2 inches, round his leg, above the knee, 3 feet 3 inches; round his ankle 2 feet 2 inches. He eats 130 weight a day, and drinks all kinds of ſpiritous liquors; ſome days he has drank 30 bottles of porter, drawing the corks with his trunk. He is ſo tame that he travels looſe, and has never attempted to hurt any one. He appeared on the ſtage, at the New Theatre in Philadelphia, to the great ſatisfaction of a reſpectable audience.

A reſpectable and convenient place is fitted up at Mr. VALENTINE's, head of the Market, for the reception of thoſe ladies and gentlemen who may be pleaſed to view the greateſt natural curioſity ever preſented to the curious, and is to be ſeen from ſun-riſe, 'till ſun-down, every Day in the Week, Sundays excepted.

☞ The Elephant having deſtroyed many papers of conſequence, it is recommended to viſitors not to come near him with ſuch papers.

☞ Admittance, ONE QUARTER OF A DOLLAR.——Children, NINE PENCE.

Boſton, Auguſt 18th, 1797.

BOSTON: Printed by D. Bowen, at the COLUMBIAN MUSEUM Preſs, head of the Mall.

◂ Old Bet in Boston, 1797. Visitors were advised not to go near her with valuable papers, because she had destroyed many of them

THE CROWNINSHIELD ELEPHANT

The surprising story of Old Bet, the first elephant ever to be brought to America

By George G. Goodwin

Associate Curator of Mammals
American Museum of Natural History

NATHANIEL Hawthorne, in his introductory note to *The Scarlet Letter*, wrote: "Here on the granite steps of the Custom House in Salem, Massachusetts, you may greet the sea-flushed ship master just in port with his vessel's papers under his arm in a tarnished tin box." When he wrote this he may have been thinking of his own ancestors, who for over a hundred years had braved the salt spray and gales on ships that sailed the high seas to India and the Orient to bring back precious perfumes, spices, silks, tea, ivory, and other rare products.

From the pages of one of these old logbooks, as well as from sea captains' letters that have lain forgotten for more than a century and a half in the archives of the Essex Institute, comes an interesting story that was front-page news in its day. This story definitely fixes the date when the first living elephant set foot on American soil. It was on April 13, 1796, and the port was New York. It is the story of an enterprising sea captain who had something of the spirit of the great P. T. Barnum beneath his rugged exterior.

The logbook, now faded and stained with brine, was written in the handwriting of one Nathaniel Hathorne, the father of Nathaniel Hawthorne, the author, who later added the "w" to the family name. He must have been an officer on board the Private Armed Ship *America*.

The captain of the ship *America*, was Jacob Crowninshield, who came from a family of shippers that ran the firm of George Crowninshield and Sons of Salem. There were five brothers, all in command of ships in trade with India about this time.

The *America* set sail from Calcutta for New York on December 3, 1795. Nothing of interest appears in Nathaniel Hathorne's Logbook until Wednesday, February 17, 1796, at St. Helena. "This day begins with moderate breezes . . . latter part employed in landing 23 sacks of coffee . . . took on board several pumpkins and cabbages, some fresh fish for ship's use, and greens for the elephant." Below is written in large letters "Elephant on Board." On February 24, the *America* stopped at the island of Ascension, where the men got several turtles and saw a large sea lion. The last page in the Log records the sighting of Long Island at 7:00 P.M. on April 11. From the times and distances, it can be estimated that the elephant must have been landed in New York on April 13, 1796.

The voyage had been a remarkably calm one. Except for a few squalls, no storms were recorded. The next important information we have concerning the elephant seems to be a clipping from a New York paper dated April, 1796. It reads: "The Ship *America,* Captain Jacob Crowninshield of Salem, Massachusetts, Commander and owner, has brought home an elephant from Bengal in perfect health. It is the first ever seen in America and is a great curiosity. It is a female, two years old."

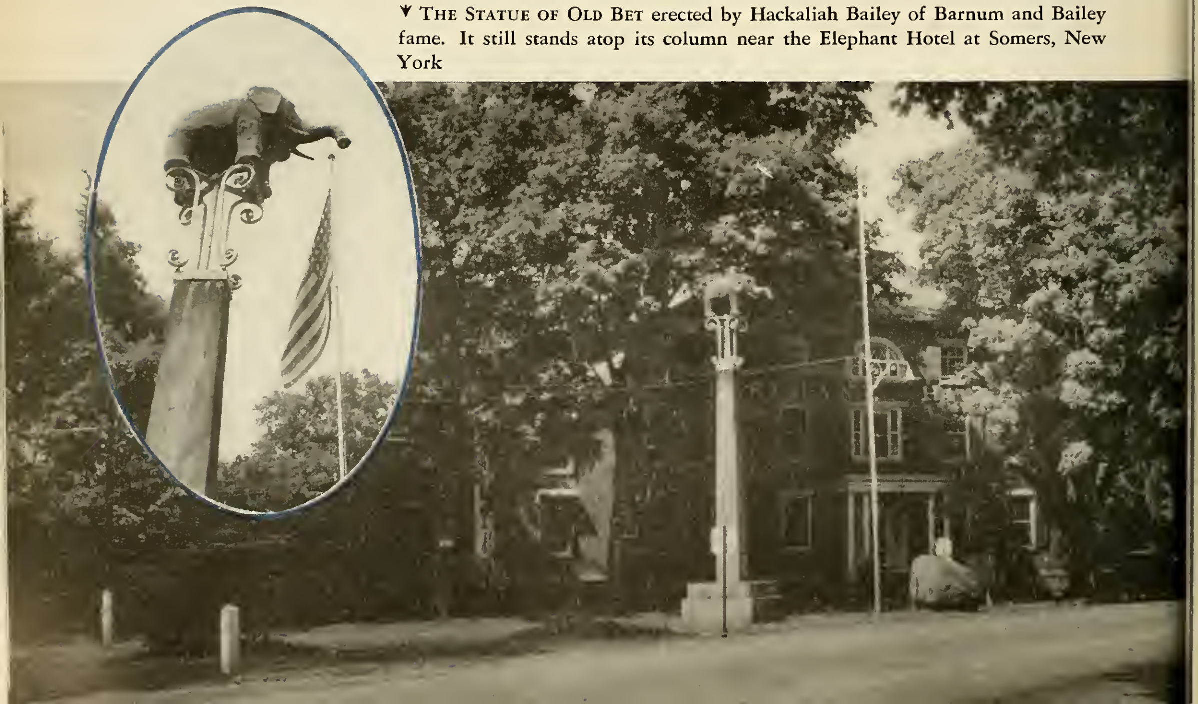
From a pile of letters, sea journals, and charts that have lain securely ensconced in an old sea chest of John C. Crowninshield for well over a century, we can learn something of the human side of the venture. Jacob Crowninshield writing in India to his brothers John and George in command of the *Belisarius* on the way to India on November 2, 1795, says: "We take home a fine young elephant two years old, at $450.00. It is almost as large as a very large ox, and I dare say we shall get it home safe, if so it will bring at least $5000.00. We shall at first be obliged to keep it in the southern states until it becomes hardened to the climate.

"I suppose you will laugh at this scheme, but I do not mind that, will turn elephant driver. We have plenty of water at the Cape and St. Helena. This was my plan. Ben did not come into it, so if it succeeds, I ought to have the whole credit and honor too; of course you know it will be a great thing to carry the first elephant to America."

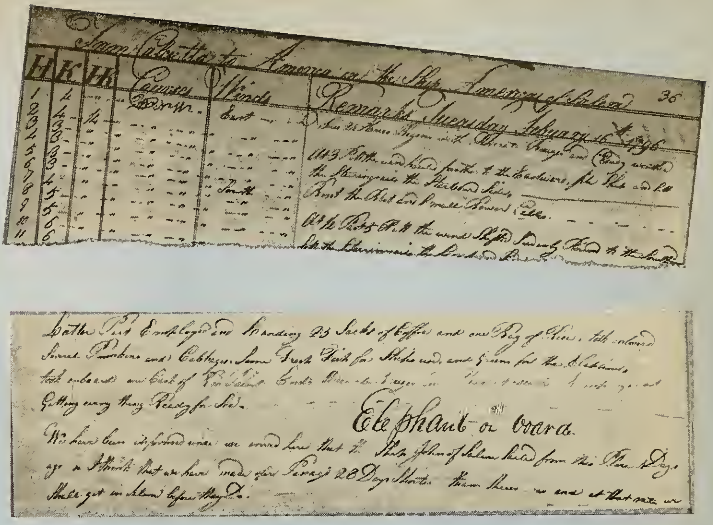
The fact that the *America* was the ship that brought the first elephant to the United States is corroborated in "An Account of the Private Armed Ship *America* of Salem by B. B. Crowninshield," also in the Historical Collection of the Essex Institute. This record states that the ship arrived from Calcutta at New York in April, 1797, and mentions that the animal sold for $10,000. He had the facts right except that the year should have been 1796.

Various writers on early American events fail to agree on the date of the landing of the first elephant in America. They put it all the way from 1776 to 1833. Much of the confusion seems to be due to the fact that there have been many ships named *America.* The one that carried the elephant was a French vessel bought for Elias Hasket Derby at the Isle of France by Jacob Crowninshield in 1794. She was insured in March, 1795, and was taken over by Jacob and Benjamen Crowninshield, who immediately sailed for Calcutta. She returned to New York April 13, 1796, and was sold in the early summer.

A summary of the travels of the elephant can be traced through newspaper reports and public notices. The first account is in *The Argus and Green Leaf Advertiser,* which on April 23, 1796, and in many succeeding issues advertised the first elephant as being on exhibition in New York at the corner of Beaver Street and Broadway. The next record is from a handbill dated August 18, 1797, advertising the exhibition of the elephant at Boston. On September 5, 1797, the Salem *Gazette* states that, "The elephant will leave town in two days



▼ THE STATUE OF OLD BET erected by Hackaliah Bailey of Barnum and Bailey fame. It still stands atop its column near the Elephant Hotel at Somers, New York



From Calcutta to America in the Ship America of Salem

Remarks Tuesday February 16th 1796

Elephant on board

▲ **Nathaniel Hawthorne's Father**, evidently an officer on Board the *America,* wrote this entry in the ship's logbook. His handwriting grew large when he referred to the first elephant ever to come to America

and go to Marblehead for three days." On September 12, the *Gazette* carried this announcement: "The elephant will be exhibited in Beverly at the new house opposite Captain Goodridge's."

The elephant appears to have been taken south about this time for the winter, and according to harbor reports was brought north to Philadelphia in April, 1798. (This entry evidently misled a writer in the Chicago *Inter-Ocean* in October, 1895, who claimed this date for the arrival of the first elephant in America.) Mr. E. Savage, one of America's earliest showmen, exhibited the elephant in Boston on June 25, 1804, and on July 3 it was again in Salem and on view at the Sun Tavern.

"Old Bet" seems to have been the name that was applied to this elephant, and the animal was eventually acquired by Hackaliah Bailey, who got together the first American circus and became the Bailey of Barnum and Bailey Circus fame. He was originally a farmer at Somers, N. Y. At this point, the record becomes a bit confusing, perhaps because there may have been another "Old Bet" fifteen or twenty years later. Or, as suggested above, repeated returns of the original elephant from the South may have been heralded by careless reporters as the arrival of the first elephant ever to reach America.

Suffice it to say that the Bailey Circus consisted of four wagons, a trained dog, several pigs, a horse, and of course the elephant. Bailey toured the country for several years with Old Bet as his chief attraction, and when he returned to Somers in 1824, he built the hotel that is still standing, known as the Elephant Hotel. He also promoted what was called the Zoological Institute.

The diarist William Bentley saw Bet at the Market House in Salem on August 30, 1797, and described the elephant in detail. From his narrative there is no doubt that this was Crowninshield's elephant.

What, we ask, became of Old Bet? Bentley was at the exhibit of 1816 when an elephant was killed, and he mentions the killing of the poor beast by a crank in Maine who felt that the animal was taking money from the public. "A boy was induced," he writes, "to secrete himself as she passed on the road and to test the story that her hide was bullet proof. He did so, the shot hit her in the eye and instantly killed her." However, the Boston *Herald* of December 30, 1895, claims that Old Bet was maliciously killed in Rhode Island in 1816. This is based on a statement in a catalogue of Barnum's American Museum in New York, where Old Bet's remains were viewed by hundreds of thousands of people. If this was Old Bet, she was apparently twenty years old when killed. It is questionable whether a boy with the ammunition of those days could kill a twenty-year-old elephant by shooting it in the eye. Certainly death would not be instantaneous. To complicate matters further, a writer in the Boston *Herald* on December 22, 1895, claimed that Old Bet was killed in North Carolina in 1827. The stories of the Maine and/or Rhode Island killings, though apparently true, may have applied to another elephant.

In any case, Bailey erected a monument to Old Bet on the green in front of his Elephant Hotel at Somers, New York, about fifteen miles east of Peekskill. The image is carved in wood and stands on a shaft of dressed granite. Here, one can still see one of the most remarkable statues in existence–the figure of an elephant on a tall column.

In 1922, about a century after Old Bet's death, "Old John," the star performing elephant of the herd of Ringling Brothers, Barnum and Bailey Circus, took a wreath on his trunk and placed it on the monument of Old Bet at Somers Village, while "the children had a holiday and sang the *Star Spangled Banner.*"

Other elephants came and went. There seem to have been additional Old Bets; there was also a famous big fellow named Mogul, and, of course, Jumbo. But the original Old Bet was the first to arrive in America and the only elephant to have been given such a memorial.

COMING

In the near future, readers of Natural History *will have opportunity to read the dramatic story of Jumbo, the most celebrated elephant that ever lived.*—Ed.

Forster photo

^ THE STAHL SITE, where the ancient houses were found, lies just one-eighth of a mile off U. S. Highway 395, the main road between Los Angeles and Reno

Exploring the Past

America's

Discovered by an amateu

continent we

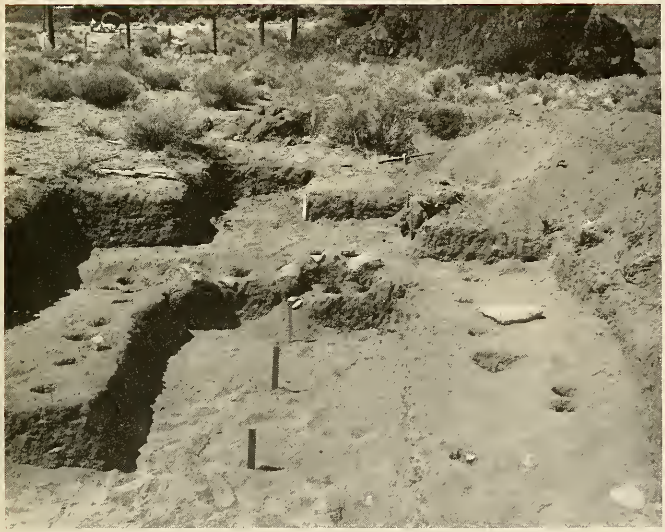
v U.C.L.A. STUDENTS excavating the ancient village. In the background are the tents occupied by the expedition

Oldest Houses

rchaeologist, the oldest known dwellings on the American
uilt by a people who may have found abundance in a region now arid

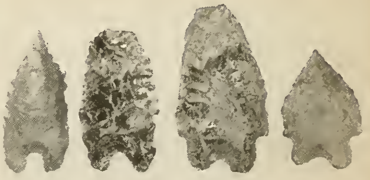
By Andrew Hamilton

▲ **Mark R. Harrington,** veteran explorer and authority on the Indians of the Southwest, photographing the inside of the near-by Stahl site cave



▲ **Excavated pinto house,** rectangular with rounded corners. The holes originally contained poles that supported the roof

▼ **Pinto points:** spear points made of obsidian and chalcedony. Such points were the first clue that an ancient Indian tribe had once lived at the south end of Owens Valley in California



In more than one detective story, the sleuth, when asked how he found the criminal, says, "I just imagined where I'd go if I were the chap. I did, and there he was."

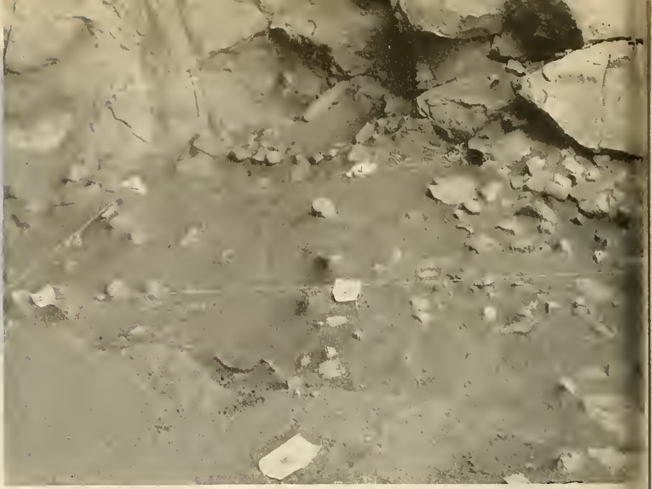
That's roughly how one of the most exciting archaeological finds in the United States—the famous Stahl site near Little Lake, California—was discovered. It contains what are said to be the oldest houses in America, and it will probably yield archaeological treasures for years to come.

Most people think of Indians as living in buffalo skin tepees or caves, as the plains tribes and the cliff dwellers of the Southwest actually did. But there were many tribes that dwelled in crude huts built out of branches or logs with well-defined walls and roofs.

The Stahl site is about 180 miles north of Los Angeles, flanked on the west by the southern tip of the snow-capped Sierra Nevada and on the east by the barren desert mountains beyond which lies Death Valley. It contains evidence of three of the most primitive Indian houses ever found. They are believed to be not less than 3000 years old, nor more than 10,000.

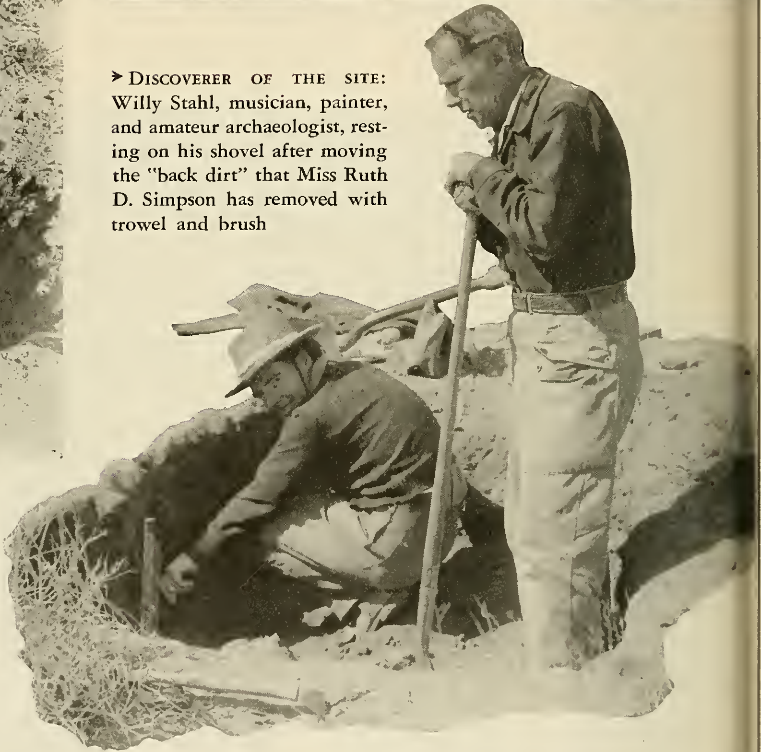
The site of these "oldest houses" was discovered one winter day in 1947 by Willy Stahl, Los Angeles musician, painter, and amateur archaeologist. The great semiarid trough of Owens Valley, in the southern end of which the site lies, receives almost no rainfall, because clouds traveling east over California

➤ Inside the Stahl site cave, just below the surface, where objects of later Indian origin were found. Note the stone pestle at the rear, just where it was found



➤ Miss Ruth D. Simpson, Assistant Curator of the Southwest Museum at Los Angeles, at work with a 5-inch trowel—"the largest tool we use," Mr. Harrington said when offered a bulldozer

➤ Discoverer of the site: Willy Stahl, musician, painter, and amateur archaeologist, resting on his shovel after moving the "back dirt" that Miss Ruth D. Simpson has removed with trowel and brush



deposit their rain and snow on the heights of the Sierra before they reach this valley. Indeed, this is the location of Mary Austin's famous book, *Land of Little Rain.*

However, Stahl knew that the Owens Valley, following the last glacial era, had been fertile and well watered. Trees, grass, and flowers grew plentifully where now only cactus and creosote bushes struggle. Game had probably been abundant, and without doubt, he reasoned, early Indian tribes lived in the valley.

Climbing to the top of a barren volcanic lava flow, Stahl gazed out over the desert. He could trace an ancient river bed and a dry "fossil" waterfall. "If I were an Indian, I'd camp on that knoll below the waterfall," he decided.

Down the steep cliff he climbed and hiked over to the low mound he'd picked out. He dug a few holes —none of them more than three feet deep—and found some black obsidian spear points and some crude stone scrapers.

"All it took was a little imagination and an amateur's interest in archaeology," Stahl said later.

When he returned to Los Angeles, Stahl looked up an old friend, Mark R. Harrington, white-haired curator of the Southwest Museum and a leading expert on the Indians of the Southwest.

Harrington examined Stahl's obsidian spearheads with great interest.

"Pinto points," he declared.

Pinto refers to the Pinto Basin near Twentynine Palms, 200 miles southeast, where William R. and Elizabeth Campbell in the early 1930's first found spear points and stone implements on the bank of another dry river. The Campbells' report, entitled *The Pinto Basin Site* and published by the Southwest Museum in 1935, has been called a real milestone in American archaeology.

The Campbells had suggested that the Pinto culture existed not only in the area around Twenty-nine Palms, but in the entire stretch of desert that lies between California and Nevada—running as far north as the Owens Valley. Since then it has been traced from northern Nevada to Lower California and east to New Mexico.

Stahl's handful of spear points and scrapers seemed to bear out this theory.

"If Pinto points are to be found near the surface, the deposit on which they lie should be as old or older," said Harrington. "Perhaps we can excavate a campground of this early American Indian culture with all its features in place."

On March 8, 1948, Harrington, Stahl, Miss Ruth D. Simpson, and a small group of volunteer diggers returned to the site where the original discovery had been made. One of the most faithful volunteers who worked with this original party was a busy orange grower, Mr. Ritner J. Sayles. The spirit of the game got into his blood, and Mr. Sayles has been a member, at least part-time, of every expedition since.

For three months this Southwest Museum archaeological party criss-crossed the area with trenches, working enthusiastically even when the 110-degree summer sun made perspiration trickle down their noses. Using small hand trowels, nut picks, and paint brushes for the slow and painstaking excavating itself and shovels for removing surplus "back dirt," they trenched the sandy mound to a depth of from two to eight feet.

Almost every type of stone weapon or tool that the Campbells had found in the original Pinto Basin site farther south turned up in the Stahl site. There were nearly 200 spear points as well as hundreds of manos and metates for grinding acorns and seeds, scrapers for cleaning animal skins, and crude stone knives.

▲ **The Pinto Indians** lived in caves as well as houses, for their implements have been found in the rock shelter shown in this photograph

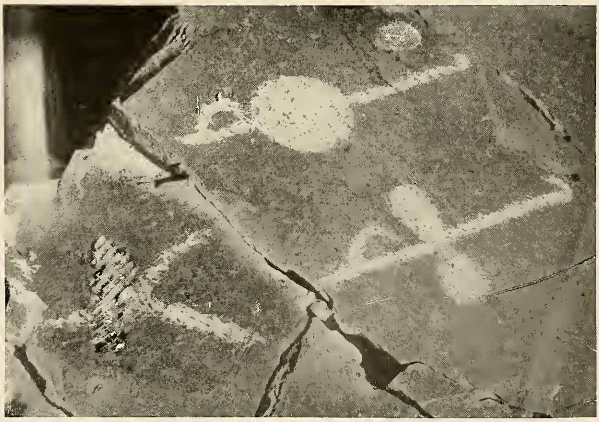
As each specimen was uncovered, it was carefully labeled and its exact location horizontally and vertically was noted. Later these specimens were taken back to the Southwest Museum, sorted, and classified. Like pieces of a jigsaw puzzle, when put in place they will give the archaeologists a fairly complete picture of the Pinto culture.

Most of the implements were made of obsidian (a glasslike rock), chalcedony (related to agate), or hard metamorphosed shale. The obsidian comes from an ancient quarry near by, which evidently supplied the Pinto Indians for miles around.

Because the Stahl site lies only one-eighth of a mile from U. S. Highway 395, one of the main traffic arteries between Los Angeles and Reno, there were frequent visitors to the diggings.

On one occasion, three well-dressed businessmen drove up to the site.

"We own a mine up the road a way," they said. We saw in the papers you were working, and we thought we'd offer you our bulldozer if you can use it."



▲ **Petroglyph** on rocks near the Stahl site illustrating an ancient Indian spear thrower used in hurling stone-tipped spears

Harrington thanked them for their offer and held out a five-inch pointing trowel:

"Here's the biggest tool we use."

Amateurs can either be a headache or a help to the professional archaeologist. The so-called "pot hunter," the vandal who goes in with scoop, shovel, and pickax, hoping to find a complete Indian earthenware jug filled with glittering gold or a skeleton wearing emerald and ruby jewelry, can often undo the serious archaeological work of years.

But the amateur archaeologist who appreciates what the professionals are attempting and takes guidance from them is often invaluable. Stahl was one of these. So were members of the Archaeological Survey Association of Southern California and anthropology students under the direction of Dr. George W. Brainerd of the University of California at Los Angeles who worked with Harrington at the Stahl site.

In fact, it was B. E. McCown, an engineer and amateur archaeologist from San Diego, who really discovered what are thought to be the oldest houses thus far found in North America.

With his wife Hazel and 22-year-old son, McCown volunteered to help excavate the Stahl site over the 1948 Fourth of July week end. He was assigned to remove the soil from Square A-5 (a square yard), and he lifted it out with the greatest care. First he troweled away about three inches of loose "blow sand," then some 10 or 12 inches of a more compact sandy material. Then came a darker, harder layer, blackened by the leaf mold of the long-vanished forest and the camp debris of the ancient people who had once lived on the spot.

Finally McCown reached a hard-packed dark stratum about 22 inches below the surface on which rested a very thin layer of sand. Brushing this away, he found that the hard layer was pierced by a circular hole, which was four inches in diameter and filled with softer material.

"What's this—an animal's burrow?" McCown wondered.

But when he uncovered three such holes, all the same size and spaced at intervals of 14 inches, he called to Harrington, "I think I've found something good!"

Harrington and the others gathered around McCown and helped to excavate squares adjoining the lucky A-5. A total of 14 holes were soon located, outlining what seemed to be the foundation for the north and west side of an ancient house. The east side was uncovered later.

This first early Indian house or hut measured some 13 by eight feet—about the same size as the tents used by the archaeological party. The entrance was either at the south or the east end, a common practice among Indian housebuilders.

"What the superstructure may have been, we have no way of determining," says Harrington. But as the posts were placed vertically in holes in the ground, we may guess that they terminated in forks supporting a flattish roof of poles covered perhaps with tules.

"The walls may have been willow wattle work, woven in between the poles. Possibly the roof and walls were plastered with mud. But of this we have no evidence one way or another. There was no floor except the hard-packed earth. No fireplace was located, although a deposit of burned bones lay near the hut."

To date, a total of three Pinto houses have been uncovered on the Stahl site. The second was circular in shape, and the third rectangular like the original discovery. Harrington is certain many others exist and will be uncovered by further excavating.

"There is no doubt that these houses were built and used in the Pinto period," he says. "Pinto points, grinding stones, and charcoal were found in and near the houses. And conversely, no modern objects appeared. Moreover, the earth that was excavated didn't appear ever to have been disturbed."

How old is Pinto? Archaeologists are still trying to gather evidence to answer this question. Most of them agree that the Pinto Basin people flourished at least 3000 years ago; other estimates go back to 10,000 years.

Previous to the discoveries of Pinto culture near Twentynine Palms in 1935 and Willy Stahl's find in 1947, the oldest known human habitations on the North American continent were the pit dwellings of the Basketmaker Period. These were built during the early centuries of the Christian era—less than 2000 years ago.

"That makes the Pinto houses, which must be at least 3000 years old, the oldest human habitation outside of caves thus far reported in North America," Harrington points out.

"However, we must not picture the Pinto people as living only in huts. They occupied caves also. This we know from our excavations in a small cave at the northwest corner of the Stahl site."

Pinto man was a rather primitive type of Indian. He made no pottery and knew no agriculture. In all probability he was a wanderer who hunted game and gathered berries, grass seeds, acorns, pine nuts, and roots—and was just beginning to learn to settle down and live in one place. His weapons were primitive spear throwers for hurling stone-tipped spears, because he hadn't yet learned the principle of the bow and arrow.

Although Harrington estimates that 300 or 400 Pinto culture Indians must have lived at the Stahl site, only a few human bone fragments have been found so far. Bones of food animals that once roamed the then green valley that is now sandy desert are much more plentiful.

"Now if we could find a complete human skeleton, that would be the real prize," says Harrington. "Spear points, scrapers, knives, post holes, and animal bones are all interesting to the archaeologist. But as Alexander Pope said, 'The proper study of mankind is man.' And until we find a human skeleton of Pinto Man, the story will not be complete."

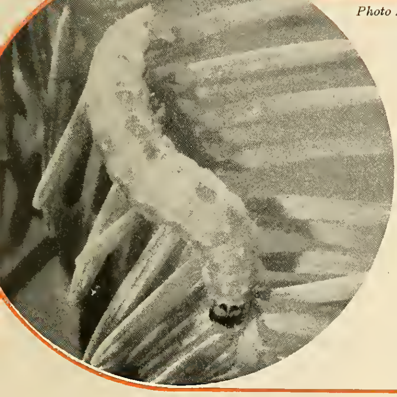


Photo Department of Lands and Forests, Ontario

Photo by C. F. Brockman

The dawn patrol of the Douglas fir forests: A typical Spruce Budworm control crew with plane. The "enemy" is seen at left, the caterpillar of a three-quarters-inch moth, which is threatening some of our finest stands of timber in the Pacific Northwest

AIR BLITZ

on the Budworm

By C. FRANK BROCKMAN

Scientific shock troops of the tall timber use new methods in combating a foe that threatens to devastate a rich area larger than the state of Delaware

PAUL Bunyan, if one believes the legends of the tall timber, was quite a man. He never faced a job too big or a problem too tough. With the aid of his faithful blue ox "Babe," he tackled and solved them all. But oxen have long since gone out of style in the logging woods, and even this hinterland Hercules would find his hands full if he were here today in the Pacific Northwest, faced with the problem of controlling the ravages of the most recent threat to the forests of this area–the Spruce Budworm.

The fabulous Paul might even be confused by the insect's name, for it is not a worm. Further, while it is occasionally seen on spruce trees when they are interspersed among more preferred ones, the spruce budworm has done no commercial damage to spruce in the Pacific Northwest. Its name is derived from its feeding habits in northeastern United States and Canada.

For the past several years this destructive forest enemy has taxed the energies, ingenuity, and intelligence of a large segment of foresters and lumbermen in Oregon and Washington, and still the job is incomplete. But the insect will have to be brought under control soon or the basic industry of the Pacific Northwest, upon which a quarter of a million people depend directly for their livelihood–an industry that supplies more than a quarter of all the forest products used by the nation–will be seriously hampered.

Reports of the Spruce Budworm Action Committee–made up of a group of leading foresters and lumbermen representing private, state, and federal interests–give a wide variety of statistics to show how urgent it is to control this pest.

Over two million acres of timberland, containing more than twelve million board feet of potential forest products, are affected. This area is considerably larger than the state of Delaware. And just as it stands in the woods–"on the stump"–the endangered timber is conservatively valued at 63 million dollars. Further, when one adds the costs of logging, manufacturing, and marketing, which contribute to the value of the finished products that could conceivably be derived from these infested stands, the figure balloons to over one billion dollars.

Even this does not indicate the full size of the monkey wrench that this little moth has tossed into the machinery of the Pacific Northwest forest industry. Most of the damage already done lies outside the higher quality timber zones, and the spruce budworm threatens to invade untouched forests of tremendous size and importance. The existing areas of infestation present a major threat to the sustained yield management of Northwest forest lands.

And don't overlook the fact that properly managed forest lands have values other than lumber production. The recreational utility of a forest damaged in this manner would obviously be impaired. Fire hazards and fire control costs on such lands would be increased materially, because extensive areas of lifeless snags form a veritable tinderbox from which could develop a series of major conflagrations. The danger of soil erosion, floods, and flood damage, and the impairment of water supplies—which in many sections of this region are barely sufficient to meet current needs—would be vastly heightened if extensive forest areas were laid waste. Such damage could easily mount to calamitous proportions.

Foresters and lumbermen have been aware of this threat. The spruce budworm has long been a destroyer of spruce and balsam fir in the northeastern states and Canada. From work carried on in those regions much has been learned that can help to solve the problem in the Northwest. Here, however, spruce is little affected. Instead Douglas fir, the most valuable northwestern timber tree, is the principal victim. To date, over one million dollars have been spent in a successful fight against the spruce budworm on a large part of the infested area. But the job is only partially completed. Maximum benefits derived from the efforts of the past several years depend largely upon the immediate completion of the control program in the remaining areas of heavy infestation.

The spruce budworm is known to have been present in the Pacific Northwest for many years, but until recently it has caused little damage or worry. True, minor outbreaks have developed on several occasions in the past, but they subsided before there were serious timber losses. In 1948, however, when the infestation in the Blue Mountains of northeastern Oregon attained dangerous proportions and gave no indication of abating, tests were made to determine the best methods of halting further damage. From these experiments evolved the methods used during the past two or three years, beginning with a "dress rehearsal" on two of the more critical infestations during the summer of 1949. In that year some 260,000 acres of forest land in the vicinity of Eugene and Mount Hood, Oregon, were sprayed by means of airplanes with a DDT-fuel-oil mixture. At a cost of $1.20 per acre, more than 98% of the budworm larvae, or caterpillars, were destroyed on the acres treated. The success of this program resulted in an intensification of the control activities in the summer of 1950, when nearly one million acres were similarly sprayed with even better results. The elimination of the budworm larvae was just as effective and the cost was reduced to about $1.06 per acre by virtue of better operational procedures. Further, in addition to regular control activities, experiments were conducted with various DDT combinations, as well as with other insecticides, which gave promise of even greater savings in the future.

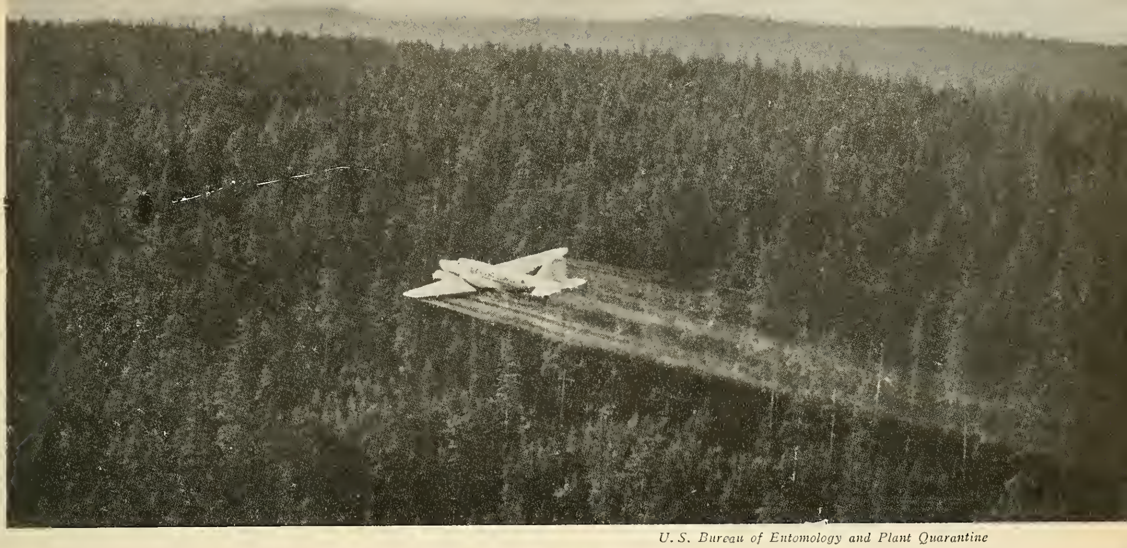
The spruce budworm, in the adult form, is a small, inoffensive looking gray-brown moth with a wing expanse of about three-quarters of an inch. Under normal conditions, it would pass unnoticed

Photo by C. F. Brockman

U. S. Bureau of Entomology and Plant Quarantine

▲ **Loading up**: pumping the DDT-fuel-oil insecticide into a tank in the remodeled forward cockpit of the Stearman plane

➤ **Beneath** the wing of this Stearman plane a row of backward-pointing spray nozzles have been installed for distributing the DDT mixture



U. S. Bureau of Entomology and Plant Quarantine

▲ A CONVERTED B-19 BOMBER on a nonmilitary mission. Note the spray pattern in the wake of the plane as it treats a pest-ridden forest with protective mist

except by an entomologist familiar with it. But when, for some reason, natural controls are removed or overcome, the budworm develops to epidemic proportions and never fails to command attention. On several occasions during the past few years, large flights of these moths have invaded the towns of Walla Walla, Washington, and La Grande, and Enterprise, Oregon. The moths came in such numbers that the effect, as they fluttered about lighted store windows and neon signs, was not unlike a heavy snowstorm.

Several summers ago, while participating in the control program against this insect, the writer experienced one of these entomological snowstorms with amusing results. The region around Enterprise, Oregon, where we were working, is essentially "cow country." Stock raising is the principal industry. What logging is carried on deals primarily with ponderosa pine, which is not affected by the budworm. Douglas fir and other affected species of timber, while plentiful, are secondary in importance. Consequently some of the local citizenry viewed our activities with considerable skepticism. It was obvious that we were tolerated as a group of harmless "long hairs" who would soon drift to other pastures. But late one evening this attitude changed. The air of the town was suddenly filled with countless tiny moths, which fluttered through the open doors of lighted bars. Many flapped soggily into unprotected glasses of beer. Cowboys in from a long, hot, dusty day on the range, eager to quench their thirst and talk shop with their pals, were frustrated by this modern version of Pandora's box. They could neither talk nor drink in peace. The situation became critical when several poker games were broken up under the impact of the aerial invasion. From then on, interest in the insect developed rapidly. Large segments of the population suddenly became budworm conscious, and we were quickly elevated to the position of authorities on a major question.

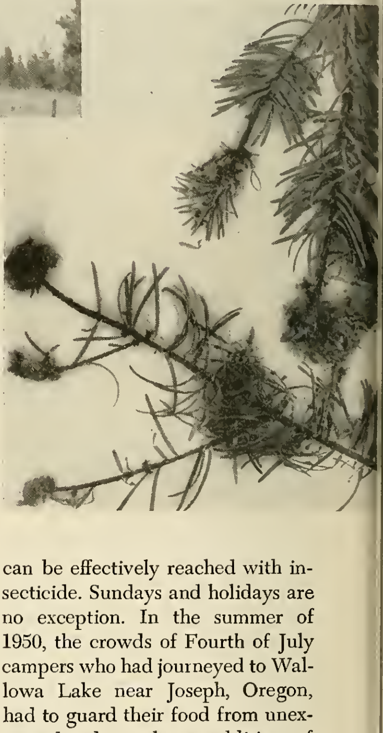
Later that same evening we decided to take advantage of the opportunity to collect specimens. The stores, although closed for the day, had lights burning in the rear, and great numbers of moths were fluttering back and forth along the plate-glass windows. As we worked back and forth along one of these store fronts with our "bug bottles," reaping an easy harvest of moths, I was suddenly startled by a stern, commanding voice. A strong hand grasped my shoulder and spun me sharply around. There stood the local police officer, in anything but a friendly mood. Although I was unaware of it, John Law evidently had missed the discussions in the local grog shops. He obviously figured he had surprised a couple of suspicious characters "casing the joint."

"What do you think you guys are up to?" he demanded. Facetiously we replied that we were "chasing butterflies"—and the expression on his face plainly indicated that now he had heard everything. It required a fancy bit of fast talking to convince him that we were serious workingmen doing one part of a technical job, and not candidates for either the hoosegow or the bughouse.

But the moth is not the direct cause of damage to the forest. The role of bogyman is assumed by the caterpillar—or larva—which feeds upon the newly developing needles as they open in the spring. From a distance, trees that have been heavily infested have a reddish-brown cast somewhat like that of a forest that has been swept by fire. The foliage has been killed or devoured. Upon close inspection, the needles at the tips of the branches look as though they have been singed by a blowtorch. If the infestation is allowed to progress for several years, continued heavy defoliation will eventually kill the timber.

◄ HELICOPTERS have been useful in pin-pointing spray in small isolated pockets that conventional aircraft cannot reach properly. Note the nozzled "outriggers"

Photos by C. F. Brockman



▼ TWIGS OF DOUGLAS FIR damaged by the larvae of the Spruce Budworm

As with all moths and butterflies, the life history of the spruce budworm embraces four distinct stages. Adult moths are in flight about mid-July, at which time they mate and lay eggs on the underside of the fir needles. In about ten days these eggs hatch, and minute caterpillars, so small that they are barely visible to the naked eye, crawl to crevices in the bark and similar places of concealment, where they hibernate until spring. At about the time the foliage buds are ready to develop, these tiny caterpillars emerge. First boring into the unopened buds, they eventually feed upon the developing needles, growing rapidly by means of a series of molts until they are about an inch long. Literally thousands of these larvae may infest a tree of normal size during a period of heavy attack. Trees of all ages and sizes are often completely overwhelmed within the relatively short feeding period of from two to four weeks. The insect then goes into the resting or pupal stage and within two weeks emerges as an adult moth—thus completing its life cycle in one year—to start the process all over again. One can readily see that, unless controlled or unless natural conditions arrest its spread, the build-up in population within a few years is tremendous. In that manner, the infestation may rapidly spread to uninfected areas.

Only during a relatively short period in the caterpillar stage, when the budworm larvae are exposed upon the foliage, is this insect susceptible to direct attack by insecticide. At that time, specially equipped planes skim over the forest about 100 feet above the treetops, releasing the DDT-fuel-oil mixture from a series of nozzles attached to the underside of the wings. This part of the operation is not one for late sleepers, for the work begins at dawn, when wind and temperature are apt to favor the success of the operation. Sifting slowly earthward, the yellowish-green spray permeates the forest as a mist of countless tiny droplets. The reaction of the budworm larvae to this treatment is immediately apparent. Many are killed by contact with the DDT. Others quickly spin silken threads and begin lowering themselves toward the ground, where they later succumb. In some cases these silken threads become so numerous that the trees appear to have been decorated with tinsel, like evergreens at Christmas. But the men who must investigate the effectiveness of the operation cannot be expected to appreciate this beauty, for they are constantly pawing their way through a maze of annoying cobwebs in the course of their work.

Time is such a vital factor in the control of the budworm that the work goes on during every available minute when the caterpillars can be effectively reached with insecticide. Sundays and holidays are no exception. In the summer of 1950, the crowds of Fourth of July campers who had journeyed to Wallowa Lake near Joseph, Oregon, had to guard their food from unexpected and unwelcome additions of protein. Planes sprayed the area that morning, and the caterpillars literally dropped in on the campers by the thousands. It is doubtful if the addition of budworm larvae would have improved a carefully prepared potato salad. Fortunately these people took the unforeseen and unavoidable situation in good humor. They knew that the DDT, in the formula used, was harmful only to the insects; and the interest generated by the antics of the low-flying planes offset the discomfiture of keeping food safely covered, or of cooking under the protection of an umbrella or a hastily spread tarpaulin.

It was interesting to watch the activity at any one of the several airstrips where the planes were fueled and loaded with insecticide. There, urgency and speed were tempered with carefully planned organization. Every minute counted. In addition, these airstrips often had to be improvised. Only rarely were existing small town airports suitably situated. In some instances, a portion of a level wheat field, rented from a rancher, was used. In other cases, a rocky plateau was leveled by a bulldozer.

The planes themselves were a far cry from the sleek jobs we are accustomed to seeing. These spray planes are "work horses." For the most part they are the old Stearman biplanes, which every pilot remembers as the basic trainer in which he first lifted himself off the ground. Experience has shown that they are the most dependable piece of flying equipment—a most important factor in this dangerous business—and that they can be most easily adapted to the nature of the job at hand. In fact, the entire setup at one of these improvised airstrips, with its dusty work-worn equipment and ordered haste, is reminiscent of an airfield in World War I. Planes roar in, jockey for position at the loading site, fill up with fuel and insecticide, and roar down the runway for another take-off. The entire process requires but a few minutes.

On each area sprayed from the air, ground checks are made to determine whether all parts were covered with insecticide and if not, to provide for reflight over them. The test is made by placing a series of 4 by 4-inch glass plates on the ground at regular intervals along a compass line. If the planes have laid down an effective application of insecticide, each of these glass plates will be spotted with a proper number of spray droplets when they are re-examined after the planes have passed over.

The effectiveness of the spray in destroying the budworm caterpillars is checked in a similar manner. Several days before spraying, ten or more trees are selected at regular intervals along another compass line bisecting each segment of the area. These are tagged so that they can be readily located later. Several branches, each about sixteen inches long, are clipped from various parts of every sample tree. Examination will disclose the number of caterpillars on these samples, and their number is recorded for future reference. In a similar manner, a final check is made some ten to fourteen days after spraying, for in that time the insecticide has completed its work. The difference between the number of caterpillars found before and after is the index of mortality—an indication of the effectiveness of the treatment.

Conservationists have been disturbed by the danger of large-scale insecticide spraying on other forms of life—on small mammals, birds, and insects in general, on pollinating and other beneficial insects in particular, and (very strongly) on fish. Where too heavy a DDT application has been used, the damage to wildlife has been serious, totally upsetting the balance of nature. Proper doses, properly applied, however, will control the forest pests without doing serious damage. Considerable research on this phase has been done by various government agencies.

Although the actual field work—the spraying and checking of results—is the most dramatic part of the budworm control program, it represents but a small part of the effort that goes into the project. In the first place, since time is such a vital factor, success depends upon careful organization. All preparations must be completed well in advance of the actual spraying. Private owners of timberland within the infested areas must be contacted and their co-operation secured. Field surveys are made to determine the extent of the infestation, and these findings are plotted on maps that will be used in briefing the pilots. The status of the budworm's development must be carefully studied by biologists throughout the winter and spring, for upon this depends the setting of the earliest possible date for effective spraying. Contracts must be let for insecticide. Flight operators must be secured. These are but a few of the countless problems that must be considered and solved before the first plane can take to the air.

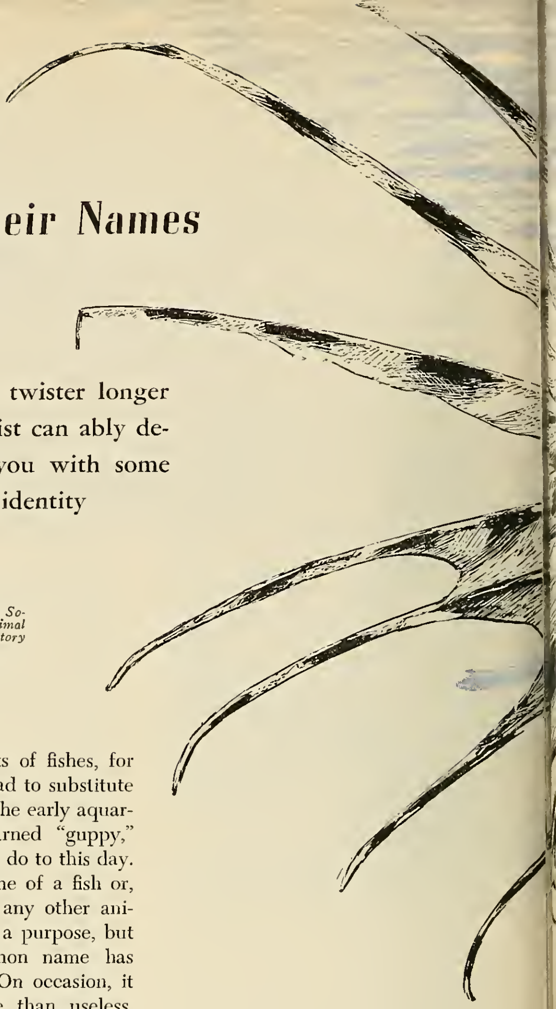
Probably the most effective single feature of this entire program is the *esprit de corps* that exists between the various co-operating agencies. Quite often, intricately co-ordinated projects of this sort figuratively fall apart at the seams at critical times owing to shortsighted personal loyalties. The spruce budworm project in the Pacific Northwest is an outstanding exception. Representatives of the U. S. Forest Service, the Oregon State Board of Forestry, private industry, and the U. S. Bureau of Entomology and Plant Quarantine—all of whom have a vital part in the program—submerge their own identities toward a smooth-working organization. Their fine success in the Battle of the Budworm during the past three years demonstrates what can be accomplished when united effort is brought to bear upon a common problem.

NEW CROP DUSTS WORRY WILDLIFE MANAGERS

DDT, an insecticide that created gray hairs on the heads of wildlife biologists a few years ago when it was first sprayed haphazardly across the nation in heavy concentrations, looks like a mild stimulant when compared to some of the more recent products of the chemists' test tubes, according to the Wildlife Management Institute.

A new crop dust called aldrin is so toxic that 3/100,000 of an ounce of the pure poison will kill a quail. Laboratory tests by James H. Dahlen of the Alabama Cooperative Wildlife Research Unit indicate that this poison is ten times as toxic to quail as toxaphene, and four times as toxic as either dierldrin or Lindane (BHC)—two new sprays that are also gaining in popularity. Fortunately, only 1/1000 of an ounce of 2.5 per cent dust is needed to kill all crop pests. The danger to wildlife lies, as in the case of DDT and the other insecticides, in its promiscuous use by individuals who mistakenly imagine that if a little is good, a lot will be better.

HOW Animals get their Names



The scientific name may be a tongue twister longer than the animal itself. But the scientist can ably defend its use, even as he entertains you with some humorous stories of mistaken identity

By Myron Gordon

Geneticist, Aquarium, New York Zoological Society; Research Associate, Department of Animal Behavior, American Museum of Natural History

WHEN a visitor comes to see the fishes in my laboratory aquarium, the first thing he usually says is, "What kind of fishes are they?"

"That small rainbow-colored one," I may reply, using the approved scientific names, "is *Lebistes reticulatus,* originally from Trinidad and northern South America. This red one with the black spots is *Platypoecilus maculatus,* from the Belize River in British Honduras. That one with the long, green swordlike tail is *Xiphophorus hellerii,* from the streams flowing down the snow-capped peak of Mount Orizaba in Mexico."

The geographical place names may be quite familiar to the visitor, but the scientific names of the fish usually stump him. If I substitute the vernacular names of the fishes and say "guppies, platyfish, and swordtails," my guest smiles knowingly.

Visitors often ask me why scientists use the cumbersome and less familiar name of *Lebistes reticulatus* when "guppy" will do. I could readily say that "guppy," spelled *guppyi,* is a scientific name, though a long-discarded one. The professional students of fishes, for technical reasons, had to substitute another name. But the early aquarists, once they learned "guppy," kept on using it and do to this day.

The common name of a fish or, for that matter, of any other animal or plant serves a purpose, but oftentimes a common name has limited usefulness. On occasion, it is downright worse than useless. Suppose you are interested in studying the natural history of wild rodents in general and the pocket gopher in particular. You are traveling through Florida on a collecting trip. In the backwoods country you stop in a likely locality for these beasts and ask a native if he knows where you can get some gophers.

"Why, we got one in our back yard. We caught it and were going to eat it, but it has become Johnnie's pet now. Want to see it?"

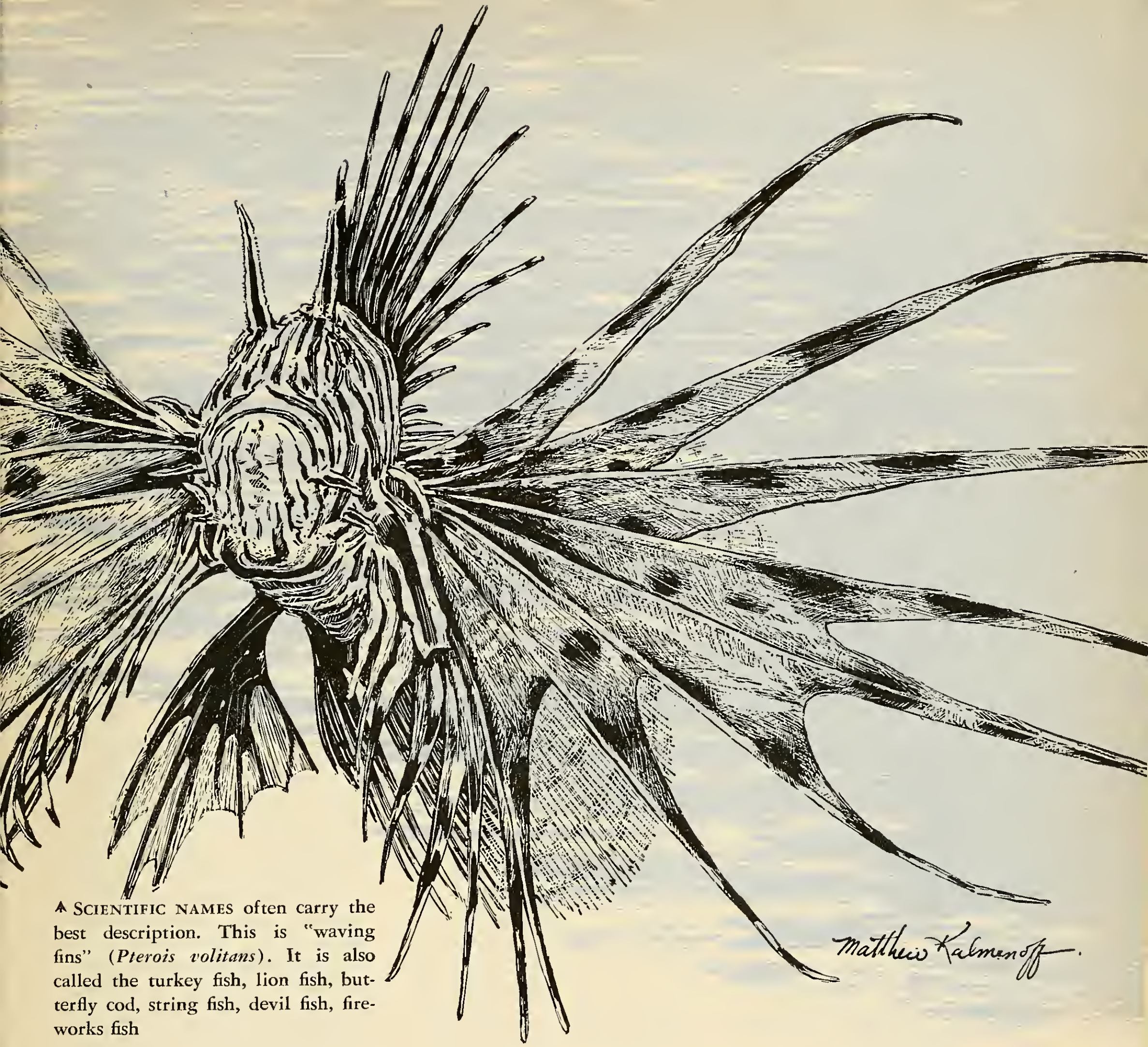
You walk behind the house, peer over the side of an orange crate, and there you see a fine big tortoise! You say, "Why, that's not a gopher, that's a tortoise." But your Southerner insists it is a gopher, and you have that awkward feeling of an outlander.

Then you get an idea. You go back to your car, dig down in your duffel, and pull out a handbook on mammals. You point to a picture of a pocket gopher, and you ask the Southerner, "What do you call this?"

"Why," he says, "anybody knows that's a salamander."

What kind of an animal would you say the swift is? The ornithologist says it's a bird, the herpetologist says it's a lizard, the mammalogist says it's a fox, and the entomologist says it is a kind of moth.

The birds are our best-known animals, for they are relatively



▲ SCIENTIFIC NAMES often carry the best description. This is "waving fins" (*Pterois volitans*). It is also called the turkey fish, lion fish, butterfly cod, string fish, devil fish, fireworks fish

large, colorful, and active. Every kind of bird in America from the Rio Grande north to the Arctic Ocean has already been discovered, described, and named by ornithologists. How many does the man in the street, or on the farm, know? Probably not more than a hundred. Of those he knows and can name, how accurate would he be if he were asked to place them in their natural and related groups? I thought I knew a robin when I saw one, but when I saw a real European robin cavorting in front of me in Kew Gardens in London, a friend had to tell me what the tiny bird was. Our American robin is not a robin but a thrush. In New York and in New England, the partridge is the ruffed grouse. The partridge in the southern states is the bobwhite; and the bobwhite is called the quail in the central states. Our blackbird is a kind of grackle. Our oriole is not a true oriole but a troupial. And the common house sparrow is not a sparrow but a weaverbird. Considering what the layman has done with the common names, you shouldn't blame the scientist too much.

Are scientific names really difficult to learn? Gardeners apparently find many technical words like Iris, Phlox, Magnolia, Chrysanthemum, and Begonia easy, for they use them all the time. Would any smoker be fooled by the name *Nicotiana tabacum* applied to his favorite weed? Any injured person in danger of infection would welcome an injection of penicillin. Actually, the name of this drug is derived from *Penicillium,* a green mold with pencil-like tufts. A related mold, *Penicillium roqueforti,* is responsible for the fine flavor of that blue cheese known as Roquefort.

One hard-bitten lecturer I knew said he could always count on getting a laugh from an aquarium society audience, however bored his listeners were, by ridiculing the scientists about the long tongue-twisting names they give tiny aquarium fishes. "Take our tiny native mosquito fish, the smallest vertebrate in the whole of North America," he would say. "Full-grown males are only about half an inch long, and adult females gravid with embryos are only slightly larger. Do you know what the ichthyologists have done?" he asks derisively. "They named them *Heterandria formosa,* a name longer than the fish." Yet he and all aquarists speak easily and with pleasure of the *Rasbora heteromorpha* in referring to a remarkably beautiful fish from Singapore. *Rasbora heteromorpha* is the only name it has, and it means "different in form from other rasboras"; and rasbora is the native name for the fish. Nobody wants to substitute a common name for this scintillating species with its bright blue fins and golden and red body coloring. Its name, *Rasbora heteromorpha,* has a fine rhythmic sound that is in keeping with the grace, beauty, and rarity of one of the most desired tropical fishes.

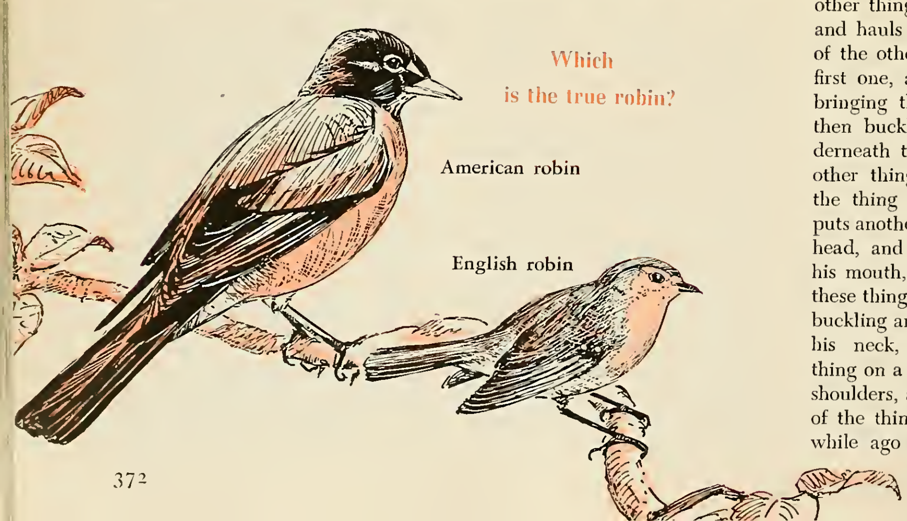
Without the scientific names, how could a Fish and Game director instruct his men? One such official, taking charge of a trout-replenishment program, found the men putting quantities of "pin-minnows" into the trout streams as food for the trout. They were planting four different species of "pin-minnows." One of them, the fallfish, grows to weigh two to three pounds and becomes one of the trout's most serious competitors for food.

Scientific names of animals and plants are part of a detailed system of biological bookkeeping, technically known as classification. In this gigantic arrangement of all the world's organisms, the names of animals alone fill more than sixty volumes, and one or two new volumes appear every year. All the animals, living or extinct, large or microscopic, terrestrial, arboreal, aquatic, or subterranean, are listed in terms of a number of ascending categories: species, genera, tribes, families, orders, classes, and phyla. These categories are intended to indicate the degree of relationship the animals bear to each other and their position in the scale of evolution.

The fundamental basis for classifying animals is the structure of the body. Particularly the skull, teeth, backbone, and locomotor appendages are used. Sometimes the type of skin and its covering are significant (fur, feathers, scales, etc.) or the kind of mouth, kind of breathing apparatus, sometimes even the kind of song. A good taxonomist, the scientist who classifies organisms, must know comparative anatomy, physiology, embryology, and the behavior of the beasts he is studying. His work is much more complicated than that of a technician who works with complicated machinery. A good automobile mechanic can tell by studying several parts of a wrecked, burned-out, and dismembered car not only the make but possibly the year and place of manufacture. Similarly, the zoologist, after years of training, can identify newly-discovered forms by studying parts of their bodies. Sometimes only fragments of bones and teeth are sufficient for him to locate the owner's place in the all-inclusive zoological catalogue. A newly-discovered jawbone from a manlike creature is likely to make the front-page headlines, because from that meager evidence anthropologists may be able to construct a reasonable likeness of the whole body.

Nobody can be an expert in a profession or business without learning the names of the tools or technical terms of his trade, be he an automobile mechanic, a lawyer, a shoe designer, or a plumber's helper. And that goes for farming, too. Words like hames, whippletree, terrets, and many more—meaningless to the city dweller—are common terms to the horse-and-buggy farmer. Mark Twain described in his *A Tramp Abroad* how they hitched horses in Europe:

"The man stands up the horses on each side of the thing that projects from the front of the wagon, throws the gear on top of the horses, and passes the thing that goes forward through a ring, and hauls it aft, and passes the other thing through the other ring and hauls it aft on the other side of the other horse, opposite to the first one, after crossing them and bringing the loose end back, and then buckles the other thing underneath the horse, and takes another thing and wraps it around the thing I spoke of before, and puts another thing over each horse's head, and puts the iron thing in his mouth, and brings the ends of these things aft over his back, after buckling another one around under his neck, and hitching another thing on a thing that goes over his shoulders, and then takes the slack of the thing which I mentioned a while ago and fetches it aft and



Which is the true robin?

makes it fast to the thing that pulls the wagon, and hands the other things up to the driver." Farmers found it easier to say "terrets" than to say "the rings that stick up in the middle of the harness on the horse's back that you pass the reins through."

Biologists took a long time to simplify and improve their rules for naming and classifying the many hundreds of thousands of animals and plants of the world. Scientific names must be internationally understood, because animals and plants, unlike man, know no political boundaries. An inventory of the world's living things must be universal in scope and written in a universal language. In the early days of scientific endeavor, during the eighteenth century, Petrus Artedi found in Naggs Head Inn in London a natural history curio in the form of a hard, dried fish. He described it, saying it was like a bony little box, triangular in shape and with two horns in front and two spines under the tail. Artedi, the father of ichthyology, translated his description of the fish curio into Latin and produced this prayer-like sounding phrase: *"Ostracion triangulatus duobus aculeis in fronte et totiden in imo ventre subcaudalesque binis."* For a while, that Latinized verbal picture was the scientific name of what we know today to be the common horned trunkfish. Later, Carolus Linnaeus, in 1758, streamlined Artedi's cumbersome appellation to the first two words, *"Ostracion triangulatus."* Linnaeus, the great Swedish naturalist, did this for all the animals and plants known to him, and in so doing he initiated the practice of Binomial Nomenclature. His invention was one of the greatest steps forward in the history of biology.

Linnaeus' fundamental book *Systema Naturae* was published in 1758. One hundred years later it simplified Charles Darwin's enormous task of producing the *Origin of Species.* Linnaeus' basic method of classification, incorporated in the modernized International Rules of Nomenclature, is in use today. New interpretations of the rules and new decisions are made by a group of present-day biologists representing many countries of the world. Their rules and regulations are rigidly enforced. The most important and the most inflexible one is that no two organisms, plant or animal, living or fossilized, shall have the same binomial. Or stated in another way, all animals of the same kind must have the same binomial.

How the "Guppy" Got its Name

The "guppy" is a household word. Pictures and stories of this tiny fish appear in newspapers and humorous magazines. It is the most prolific pet man has ever had. The guppy is replacing the guinea pig and the rabbit in the public mind as the epitome of fertility. How did the guppy get its name?

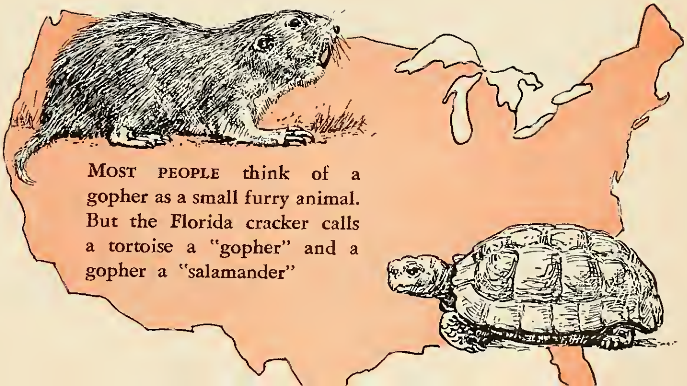
In 1859, Wilhelm Peters, in Germany, obtained and described a small fish from Venezuela which he considered new to science. He was privileged to attach to it a new name, which was *Poecilia reticulata.*

"Poecilia" is a word that had been coined much earlier, in 1801, for a somewhat similar fish called *Poecilia vivipara.* It had been invented by Mark Eliezer Bloch, a physician turned ichthyologist, and a co-worker, Johann Gottlob Schneider, a philologist. A free translation of "Poecilia" is "a little variegated one"; and "vivipara" refers to its habit of giving birth to living young.

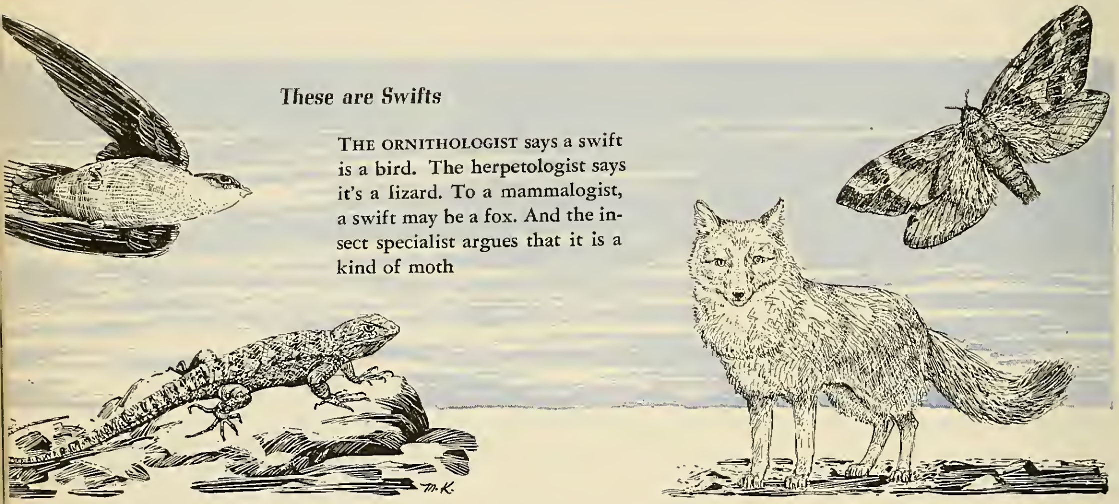
Wilhelm Peters thought that his new fish looked like, and was related to, Bloch's and Schneider's *Poecilia vivipara.* To distinguish his fish from those previously described under the term *Poecilia,* Peters gave it the new specific name of *reticulata* (meaning "reticulated" or "netted"). *Poecilia,* in scientific parlance, is called the *generic* name. It is the name of the genus. *Reticulata* is called the *specific* name, or the name of the species. Together they make up the scientific name or binomial.

Two years after Peters' description of *Poecilia reticulata* was published, F. de Filippi, an ichthyologist in Italy, described another small fish, which had been sent to him from the West Indian Island of Barbados. Whether de Felippi read Peters' account of *Poecilia reticulata* is not known, but apparently de Filippi thought he, too, had another new fish previously unknown to science. He described it carefully and named it *Lebistes poecilioides.* The generic name, *Lebistes,* had not previously been used. It informs us that, in de Filippi's estimation, this fish is not quite like the other *Poecilia* fishes described by Bloch and Schneider. The word "Lebistes" refers to a kettle or pot, probably from the pot-bellied appearance of a gravid female, and this suggests that de Filippi may have seen the female fish only. "Poecilioides" means "like a poeciliid."

Again, in 1886, Albert C. L. G. Guenther, in England, looking over the fishes sent to the British Museum by a botanist from Trinidad, separated out one type that he regarded as being different from any he had previously known. He thought this new fish was related



MOST PEOPLE think of a gopher as a small furry animal. But the Florida cracker calls a tortoise a "gopher" and a gopher a "salamander"



These are Swifts

THE ORNITHOLOGIST says a swift is a bird. The herpetologist says it's a lizard. To a mammalogist, a swift may be a fox. And the insect specialist argues that it is a kind of moth

to those under the name of *Girardinus,* a kind of Cuban toothed minnow described by Felipe Poey y Aloy in 1855, at Havana. (Poey created the word "Girardinus" in honor of Charles Girard, a famous Swiss-American ichthyologist.) A. C. L. G. Guenther, as a compliment to the collector of the fish, botanist R. J. Lechmere Guppy, named this fish *Girardinus guppyi.* It was under this scientific name that the fish was brought alive, in the early 1900's, to the attention and delight of the German and English aquarists. Guenther, a German-born English keeper of the British Museum, was the authority to whom early fish fanciers turned for guidance in matters of this sort. Guenther paid his friend Guppy a lasting compliment indeed, for "guppy" is heard everywhere—although those who use the name rarely realize its significance and history. And it is a twist of fate that a botanist should be best remembered for a fish.

Because this little fish we call guppy varies greatly in coloration and fin structure, in addition to being different in the male and female, we need not be surprised that three ichthyologists, working in different countries, all thought they had something different and new. That is how the fish known to aquarists as the guppy had three different scientific names all at the same time.

Regan – Fish Detective

In 1913, C. Tate Regan, then a young ichthyologist and later the Director of the British Museum, made a careful study of the whole group of poeciliid fishes. He discovered that the male's sexually modified anal fin, or gonopodium, was a valuable index in finding relationships between members of this viviparous group of fishes.

Regan came to the conclusion, after reading the previous publications in English, Spanish, German, and Italian, that the three names mentioned above represented mere variants of a single species. Accordingly, he was obliged to follow the rule that only one scientific name must represent it. In selecting one of the three names, Regan was bound by another regulation of the International Rules of Nomenclature. The code indicates that the *first* name applied to a specimen must be preserved, providing that the first name does not already refer to a different animal or group of animals.

The first scientific name was *Poecilia reticulata*, but the other species of *Poecilia* in the British Museum, such as *Poecilia vivipara, Poecilia parae,* etc., did not have the required closeness of relationship to *Poecilia reticulata.* So, he was unable to use *Poecilia.* He then considered the next generic name, *Lebistes,* proposed by de Filippi. Since *Lebistes* was coined especially for this fish and had never been used before for any other organism, Regan found it suitable. He therefore combined de Filippi's generic name *Lebistes* with Peters' specific name *reticulata.* Thus Regan indicated that *Lebistes reticulatus* was the valid scientific name. (The change of *reticulata* to *reticulatus* was made on grounds of gender.) Consequently, by this orderly process, Guenther's binomial, *Girardinus guppyi,* was superfluous and had to be discarded as a scientific name; but as you know, part of it, *"guppy,"* has been retained among fish fanciers ever since.

This may seem an extremely involved procedure to the lay reader. But it is inevitable that the same fish will occasionally be given different technical names, and it is essential to have a system that will provide for only one official name. Otherwise, chaos would result. An aquarist, looking in a tropical fish catalogue, would see the names: 1) *Poecilia reticulata,* 2) *Lebistes poecilioides,* 3) *Girardinus guppyi,* and he would readily conclude that three different species of colorful fishes, from northern South America, Trinidad, and Barbados, were being offered for sale.

Varieties and Species

The zoologist uses the word *variety* to represent different color variations and other minor deviations within animals of a single species. A species may have a large number of *varieties.* For example, *Platypoecilus maculatus* has many varieties, known to the aquarist as the red platy, black platy, blue platy, gold platy, leopard platy, the crescent, moon, twin-spot, one spot or comet, and many more, including the newly developed wagtail platy. Varieties are referred to by common names followed by the scientific name, as for example, gold platy (*Platypoecilus maculatus*). Varieties of species usually occur together in the same local population and freely interbreed. On the other hand, different species of a genus usually come from different geographical localities.

Locating an Aquarium Fish

To illustrate the zoological standing of a common aquarium fish, such as the wagtail platyfish, the following are the various divisions of the animal kingdom to which it belongs:

KINGDOM—ANIMAL, as distinguished from plants
Phylum Chordata—animals possessing a supporting structure called a "notochord"
Sub-phylum—Vertebrata, or chordates with backbones
Class—Osteichthyes, the bony fishes
Order—Cyprinidontiformes, the toothed minnows
Family—Poeciliidae, the viviparous toothed minnows
Genus—*Platypoecilus,* the broad, variegated kind
Species—*maculatus,* the marked or spotted one
Variety—wagtail, black-finned

Each organism is given two names, a generic name (*Lebistes*) and a species name (*reticulatus*). In scientific nomenclature, the more important name (corresponding to a person's family name) is written first, Chinese style, and the one corresponding to the given name comes second. Only the first scientific name, designating the genus, is ordinarily capitalized. Many aquarists write *Lebistes Reticulatus, Rasbora Heteromorpha,* capitalizing both names as they would John Jones and Tom Smith, but this is not conventional. The name of the person who first described the animal, if it is used at all, is placed at the end of the italicized scientific name: *Lebistes reticulatus* (Peters). The parentheses around the author's name indicates that he did not coin the generic part of the name.

Some people cannot abide technical terms—like Broadway's Billy Rose. Billy, in one of his witty "Pitching Horseshoes" stories, tells how his wife Eleanor, an expert driver, instructs him to start the car.

"Just turn this jigger over," she says, "push in this dingus, pull out this doohickey, step on this wingdoodle, press down on this thingamabob, and you're all set to go."

Billy is confused and asks, "What is this gizmo?" And so it goes.

Many biologists, being learned in Latin and Greek as well as in natural history, have created scientific names that are appropriate and delightful. I like the impish name of *Pluto infernalis* for an eel-like fish that lives in the dark underground waters of Yucatán. It is pleasing to learn that the king of the tyrant dinosaurs is called *Tyrannosaurus rex.*

Biologists are human. The sad part is that when they give way to their whims or weaknesses, the names they bestow may be difficult to eradicate. Even as late as 1926, Dybowski introduced the following generic names in describing the water fleas of Lake Baikal: *Nematoceroechinogammarus, Gammaracanthuskotylodermogammarus,* and *Parapallaseakotylodermogammarus.* We can only hope that these will not lose anything in the translation.

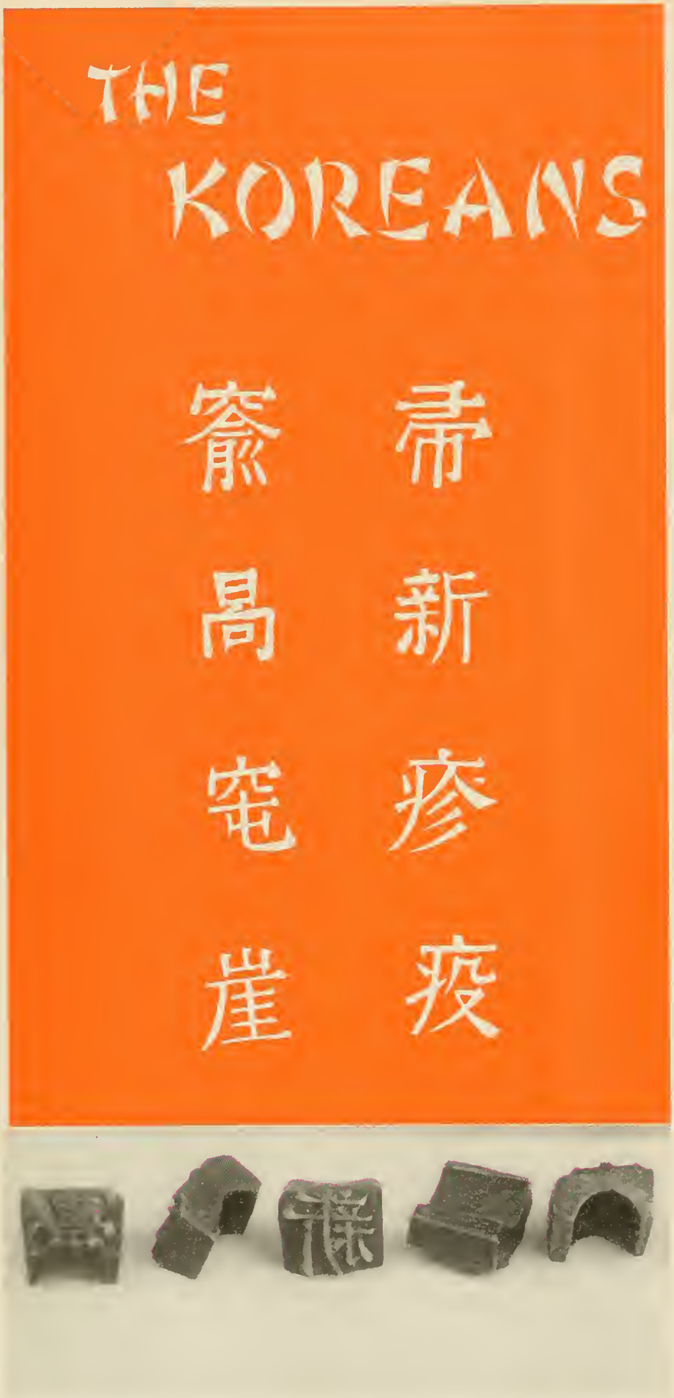
Scientists also occasionally make mistakes, some of which unfortunately will be preserved for all time. For example, the king crow or drongo is a native of the Malayan Archipelago. The taxonomist who first described it thought it came from South Africa; consequently, he named it *Dicrurous hottentottus,* meaning "the forked-tail bird from the land of the Hottentots." An early eighteenth-century zoologist thought that the common water flea was a flea (although it is really a kind of fresh-water shrimp), and he gave it the specific name of the flea, *Daphnia pulex,* which means in its entirety "the nymphlike flea." Aquarists all over the country will recognize the word "Daphnia" as the name of the tiny live organisms they buy to feed their fishes.

Biologists have used scientific names to flatter or honor their patrons or friends. An English botanist of the Victorian period named the world's largest water lily *Victoria regia.* Ornithologists of the nineteenth century graciously named the wondrous birds of paradise for the royalty of their times, so that we now have the King of Saxony bird of paradise, Crown Prince Rudolph's bird of paradise, Lady Macgregor's bird of paradise, and so on. Charles Louis Bonaparte, a French ornithologist and a grand-nephew of the great Napoleon, rebelled at this form of flattery. When he had the opportunity of naming a new bird of paradise he wrote, "I have adorned the most exquisite bird of paradise with the name of a Republic, *Paradisaea republica.* Even though a paradisean republic does not exist, at least there is now a *Paradisaea republica.*"

What are scientific names? A bit of natural history, a bit of the classical languages, and a bit of human (*Homo sapiens*) endeavor.

Movable metal type was in use i

THE KOREANS *were ahea*



AMNH Photo

▲ Early Cast Metal Type from Korea on exhibit in the American Museum of Natural History. Above, actual printing from the type shown

MILLIONS of words about Korea have appeared in print in the past twelve months, but little has been said of the Hermit Kingdom's part in the developments that made printing possible.

The story is an old one, and much of it has actually been lost. Enough is a matter of record, however, to show that Korean printers used movable type long before Johannes Gutenberg invented it in Germany. In fact, even what is supposed to be the oldest *cast metal* type now in existence was made in Korea in 1403, at least 37 years before Gutenberg's invention, and is now to be seen among the collections of the American Museum of Natural History.

The type in the American Museum was obtained in Korea in 1897 by Homer B. Hulbert, the author of *The History of Korea.* He was given the type by the Education Department in Seoul, where he found remnants of all three of the first sets of cast metal type, from 1403, 1420, and 1434. Of the oldest set, there were only 53 pieces left, and Mr. Hulbert states that those were the ones that the Minister of Education gave him. Testimony later given by the curators of the Seoul Museum, however, casts some doubt on this.

The circumstances under which the world's first metal type was cast show Korea to have been an enlightened and progressive country almost a century before Columbus came to America. The story of the invention of metal type is told in Korean in a book printed only six years after the first type was cast, as follows:[1]

"In the second moon of the first

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[1] From *The Invention of Printing in China,* by Thomas Francis Carter, Page 171.

rea long before Johannes Gutenberg invented it in Germany

f Gutenberg

By Hawthorne Daniel

year of *Yung-lo* (1403), the king said to his attendants, 'Whoever is desirous of governing must have a wide acquaintance with the laws and the Classics. Then he will be able to act righteously without and to maintain an upright character within, and thus to bring peace and order to the land. . . . The books printed from blocks are often imperfect, and moreover it is difficult to print in their entirety all the books that exist. I ordain therefore that characters be formed of bronze and that everything without exception upon which I can lay my hands be printed, in order to pass on the tradition of what these works contain. That will be a blessing to us to all eternity. However, the costs shall not be taken from the people in taxes. I and my family, and those ministers who so wish will privately bear the expense.'

"Then was money in great abundance given from the private treasury of the king, and officials appointed [list of names] to superintend the undertaking and to carry it out. The Book of Poetry, The Book of History and the Commentary of Tso were given from the royal palace to furnish models for the type. The casting began on the nineteenth day of the same month, and within a few months several hundred thousand type had been cast. . . . These type were cast in order that all books might be printed. May they extend to a myriad volumes in number and be handed down through a myriad of generations. Thus vast was the design, so deep and far-reaching the thought that inspired it."

The attitude of the Koreans toward their discovery of cast metal type was voiced further toward the end of the century: "Fortunately through the inventive wisdom of the sages of our dynasty, who have discovered the art of casting type to print books, all Classics, histories, books of philosophy and literary collections are in every home." Thomas Francis Carter, who has made a special study of printing in the orient, points out that the enthusiasm went so far that, when there was a lack of bronze, the bells of ruined monasteries and vases and instruments belonging to individuals and to the various government departments were melted up.

The casting of metal type was not the first step, of course, in the evolution of printing. Korea and China have always been in close contact, and the earliest steps in this Far Eastern field of printing took place in China.

Anyone who has ever dealt with a Chinese laundryman and has claimed his laundry by matching a torn piece of paper with the portion retained by the laundryman, must have recognized the simple effectiveness of this method of identification. But modern Chinese laundrymen were not the ones who thought that up. Long before the Christian Era began, the Chinese were using the idea. If a contract was to be made, for instance, its terms were sometimes written on each end of a piece of bamboo which was then broken in two, one piece being retained by each party. And sometimes, in order even more definitely to identify these "documents," bits of moistened clay or wax were pressed on them and stamped with the impressions of carved seals that were usually made of stone.

By the sixth century of our era such stamped impressions were often being made on paper instead of on clay or wax. A kind of red ink apparently made from cinnabar was commonly used. For this purpose carved *wooden* seals were found to serve best, and here were the first true printing blocks. It was from this beginning that block printing evolved, and whole pages ultimately came to be printed from single blocks. Thus an accurate method of duplicating handwritten copy was developed.

A piece of wood—usually pear wood or plum—was cut to about the size of a present-day sheet of foolscap. It was kept to a thickness of an inch or less, and was carefully smoothed and then soaked in water.

THE ORIGIN OF PRINTING

Date	
712-756	Probable origin of printing by wood block (China)
770	Earliest well-defined block prints (Japan)
868	Earliest book printed by block printing (China)
935-954	First paper money printed (China)
1032	Paper money printed in excess. Inflation
1068	First counterfeit bills
1041	Movable type of clay (Pi Sheng of China)
1147	Woodcuts for capital letters (Benedictine Monastery at Engelberg, Switzerland)
1403	***First cast metal type (Korea). An order for the establishment of a royal type foundry had been given eleven years earlier***
1409	Possibly the earliest book printed from cast metal type (Korea)
1420 & 1434	Additional fonts cast in Korea
1448	Earliest specimen of a European book printed from movable type, probably an independent invention
1450-55	First Gutenberg Bibles—earliest complete European books printed from movable metal type
1488-1506	Earliest printing from cast metal type in China

Next, the written page that was to be duplicated was pasted *face down* on the wooden block. When the page was dry, the paper was carefully rubbed away with moistened fingers in exactly the same way that we sometimes remove the paper from a stubborn pattern of decalcomania, leaving the inked characters still visible on the wooden block. Next, the wood about the characters was cut away with a chisel to a depth of an eighth of an inch or so, leaving the printing surface raised.

Excellent printing was attained by this method, but it had not long been in use when, about the year 1041, a certain Pi Sheng cut separate characters in wet clay and baked them hard. When he wished to print, he glued them in their proper order to a flat surface, inked this "type," and pressed his paper down upon it.

The foundation to which these clay printing blocks were glued naturally had to be rigid and strong, with the result that these "base plates"—they were actually shallow rectangular trays—were often made of iron. The clay type, however, readily broke down in use and other materials were consequently tried. In the course of time, type of this design was made not only of clay, but also of wood, iron, tin, lead, and copper.

No one of these materials, however, proved to be entirely satisfactory. Consequently alloys were evolved. These undoubtedly varied widely, but an analysis that was made of some of the Korean cast metal type in the collection of the Franklin Institute in Philadelphia—type cast in the year 1434—shows that a small amount of iron was alloyed with similarly limited proportions of lead and zinc, and with much larger proportions of copper and tin. In fact, the analysis even shows the presence of a very small percentage of manganese.

Cast type of this period was rectangular in shape and often had a wide, deep groove across the underside. As the type was set, this deeply indented base was pressed into a thick layer of adhesive, which held it firmly. The adhesive was generally a mixture containing resin and wax, and the shallow tray or "base plate" that supported the type was still commonly made of iron. Once the type was set, the printing surface was "leveled" as accurately as possible with a smooth block of wood.

There was no printing press. The printer merely sat cross-legged before his tray and used a brush to apply liquid ink to the printing surface. He then laid a sheet of paper lightly on the form, brushed or patted it with a felt pad, and carefully lifted it off. Nor was this method so slow as one might imagine. It is said that an experienced workman could strike off 1500 impressions a day.

The Chinese never developed an alphabet, but during the fifteenth century the Koreans invented one containing eleven vowels and fourteen consonants. Thus the task of printing came to be simpler in Korea than in China. Korean printing, however, was well established on a basis of Chinese characters long before the Korean alphabet appeared.

Movable type — even movable *metal* type—was in use in Korea long before *cast* metal type was evolved. The exact date at which the first movable type appeared, however, is unknown. A Korean official named Li-Ku-Po, however, who died in 1241, left a record saying that his father compiled a book that was printed from movable metallic type sometime between 1224 and 1241.

The Koreans of today are naturally proud of these achievements, just as they are proud of the fact that they built the first warship that used metal plates and a metal ram, erected the first successful suspension bridge, built the first bombs and the first mortar, and, alone among the people of their part of Asia, evolved a phonetic alphabet. And it is unfortunately probable that at the present moment many valuable old records of these and other Korean achievements are being damaged or destroyed in the struggle that now is battering so many of the cities of the long suffering Hermit Kingdom.

▲ "THE MORNING AFTER." Fences had been buried, and the whole face of the land had been altered

Malcom Epley, Jr., photos

MUD *Gusher*

Overnight a "thousand-foot" geyser buried a farm under mud, and two Californians agree that Surprise Valley is a good name for the place where they settled

By EDITH RUTENIC McLEOD

LIKE the farmer's cornfield in Mexico where the volcano Parícutin now stands, 20 acres of meadowland belonging to two farmers in Surprise Valley in northeastern California, are now covered with mud 12 feet deep in places. Early explorers had called it Surprise Valley because of their astonishment, after weeks of weary travel through arid plains and mountains, to see a long fertile valley dotted with lakes and teeming with wildlife. Now it has another reason for being called Surprise.

On the first of last March, with startling, wholly unexpected violence, a geyser-like eruption broke through the earth's crust with the roar of a tornado. Witnesses said it shot hot water and mud 1000 feet into the air. One witness asserted that the column of mud and water shot as high as one could see in the black, starlit night. The Giant Geyser in Yellowstone National Park lifts its main column of hot water to a height of 50 to 60 feet and sends a thinner column of water 250 feet into the air. So unless the estimates of the Surprise Valley eruption are gross overstatements, it represents a phenomenon that is as unique as it is amazing.

Unlike Parícutin, further growth or violence is not anticipated. But Paul Robinson, Modoc County Supervisor and rancher, and Joe Parman, rancher, are looking ruefully over their once-fertile meadowland and wondering to what account they can turn 20 acres of boiling and caking, infertile mud.

Two weeks before the eruption, Robinson recalls, there was a slight earth tremor in the area. No local earthquakes of any considerable magnitude have ever been felt by residents of Surprise Valley, even within the memory of the oldest inhabitants, though numerous hot springs have long been known to exist in the region.

For about three hours before the eruption there was a continuous rumbling in the earth, which caused considerable anxiety among those living in the vicinity. The Robinson home shook mildly. Mrs. Robinson says that she might have thought a tornado was approaching, except that tornadoes are unknown in this mountainous country.

At 10:30 P.M., the valley lived up to its name in a splendid, surprising, though terrifying manner. The Robinsons say that a violent rumble and explosion accompanied the eruption. They rushed outside and saw against the starlit sky a huge column, "black against the night like the funnel of a tornado," shooting mud and water 1000 feet or more into the air.

The scientifically-minded might

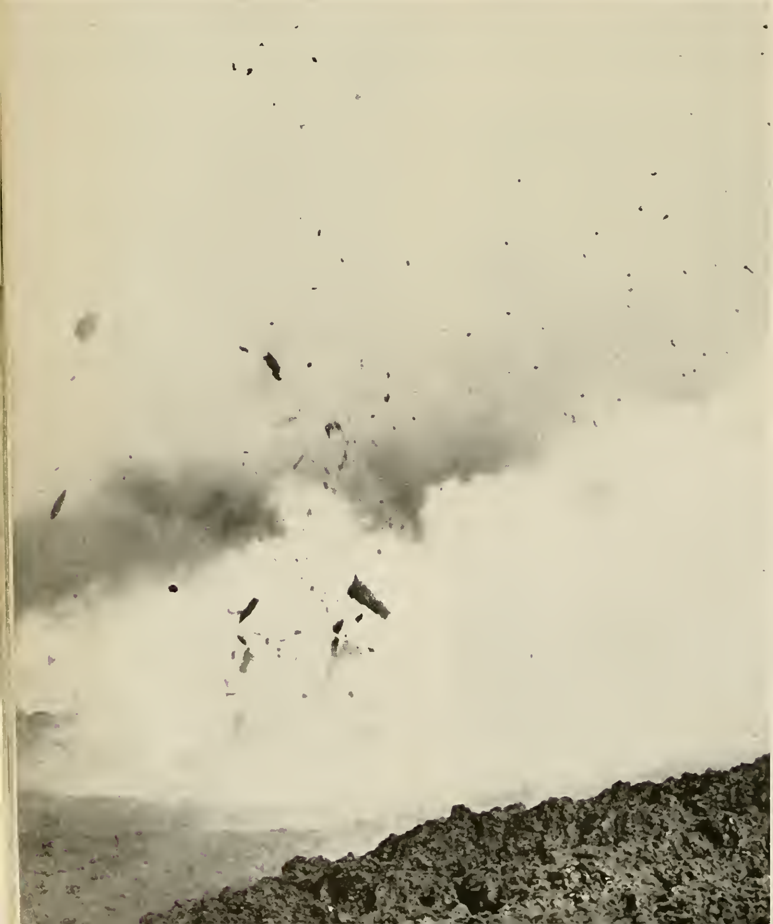
◄ A NIGHTMARE CAME TO LIFE: boiling mud pots left in the crater after the eruption have enjoyed this rare display of Nature in a violent mood, but unfortunately the spectacle took place after dark and without warning, except for the puzzling rumblings preceding the outburst. There was little sleep that night, and at 4:30 A.M., the new spring was still erupting hot water and mud high into the air. It had spattered mud as far away as four miles. Mud-spattered horses huddled in the far corner of the field, but within a short time birds were flying about, seemingly oblivious of the spouting hot spring, the steaming mud, and the changed aspect of the region.

At 10:00 A.M. on March 2, a second eruption occurred, accompanied by loud roaring. It is estimated that this second outburst sent mud and water 200 feet into the air. The spouting gradually decreased to 100 feet, and then to 75 as the day wore on.

By the following day the intermittent spouting had decreased to around twelve feet of mud and steam. The height might have been greater but for a strong wind that was blowing. The irregular craters of the hot spring, scattered over an area of about ten acres, were filled with boiling mud, and innumerable other mud pots were starting to boil. A pungent odor emanated, though it was not especially sulphuric. Surrounding these ten acres, were another ten acres of mud that thinned out toward the edges. In places, near the spring, the mud was twelve feet deep, with steam issuing from many points.

Mrs. Joe Parman says that a pole gate on the site of the eruption completely disappeared. A pole gate is a large, heavy gate, wide and high enough for a loaded hay wagon to go through. Two heavy posts about 12 feet in height support this type of gate, with a beam across the top. It is conjectured that the gate collapsed and was buried by the mud.

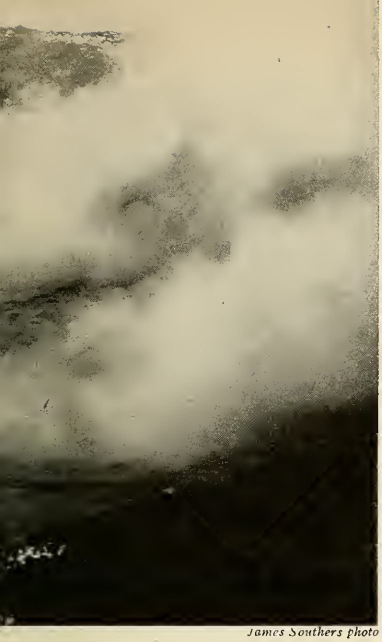
James Southers photo



◄ CHUNKS of mud were still being thrown up the second day. The big eruption took place at night

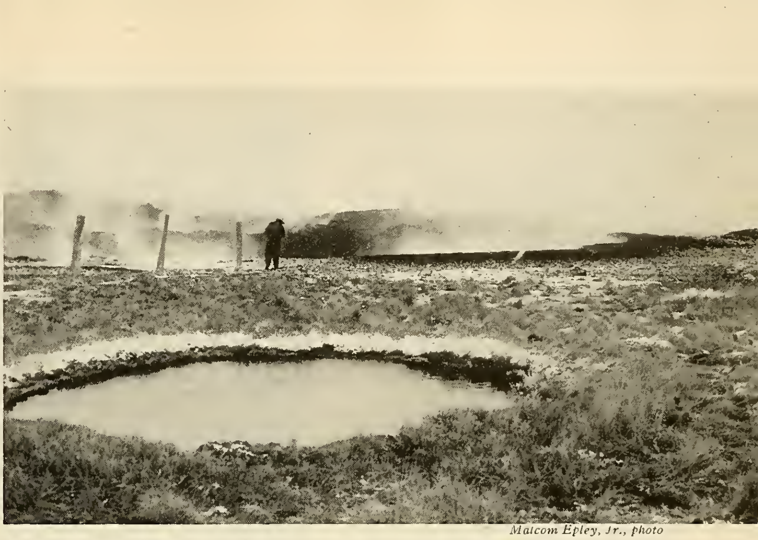
About two weeks after the initial outburst, most of the mud pots had dried up. At this stage a third, smaller eruption occurred, shooting up some mud but mostly steam, to a height of around 35 feet. This small outburst threw mud around the edges of the crater but was not spectacular. The region seems now to have settled down to a relatively quiet permanence of boiling hot springs, one of which is especially active.

The geyser-like eruption and the accompanying mud pots and hot springs occurred in a region containing about 100 hot springs, scattered over an area of 100 acres. The springs range in diameter from 6 inches to 20 feet and have been there since white men moved into the valley 100 years ago. Residents



James Southers photo

▲ THE ACTIVITY subsided gradually. A repeat performance is not impossible, geologists believe, in a region recently subjected to crustal movements



Malcom Epley, Jr., photo

▲ PHOTOGRAPHER standing near the edge of the boiling mud cauldon. The low steaming hill in the background is the heaped-up mud blown out by the first eruption. In the foreground is one of the larger hot springs that dot the meadow

assert that individual springs have been known to erupt hot water (but no mud) up to a height of 100 feet, leaving the basin empty for quite a long time.

Surprise Valley is in Modoc County, just east of the Warner Range, a range of recently faulted block mountains. A fault, in geologic parlance, is a fracture in the earth's crust, with resulting displacement. There are many of these fractures in the Warner Range. A long one lies at the eastern base of the range, and it is near this fault line that the hot springs occur. I. C. Russell, in *U. S. Geological Survey, Fourth Annual Report*, 1884, describes it as "a line of profound displacement, which has resulted in the upheaval of one of the grandest of the Basin Ranges. This line of displacement is marked by numerous hot springs and by fresh fault scarps, from 20 to 50 feet high, that cross alluvial cones and cut embankments and terraces of Quaternary age, telling in the plainest language that the rocks bordering the line of fracture have been disturbed at a very recent date, and that the Warner mountains are young, and probably growing."

Forty-four years later, in 1928, Richard Joel Russell, after making a detailed study of the range, verified all of the above statements in his published findings, *Basin Range Structure and Stratigraphy of the Warner Range.*

Hot (and cold) springs are common where faulting has occurred, for through the breaks in the earth's crust the waters below can find escape. Geologists and volcanologists agree that dynamic phenomena can be expected from time to time, on a small scale and even, perhaps, on a larger scale, not only in this particular region but all up and down the western mountain system. Volcanic activity, faulting, and mountain building have by no means ceased.

▼ ONE of the smaller mud pots. The dog's curiosity resulted in a burned foot

James Southers photo

Continued from page 338

no authenticated case of rattlesnake bite where no symptoms of any sort, such as pain and local swelling, were reported. Cyanide is certainly not recommended as an antidote to snake bite. The possibility cannot be ruled out that the snake was not in good health and would have succumbed regardless of the events as reported above. It is not uncommon for the professional collector to encounter the parasite-infested, disease-ridden animal.

Squirrel in Sock

Sirs:

The half-grown gray squirrel in these photographs was found in an old barn by Rudolf Freund, the illustrator. It is Rudi's belief that he was the runt of a litter and was abandoned by his parents. At the time of discovery, he was about six weeks old, tiny, and very weak. His eyes were open, and he had a light covering of fur. Alfonse, or "Al," as he was called, was fed warm milk, containing Viosterol, with an old medicine dropper, then wrapped in a wool sock, and placed in a box beneath a lighted bulb to keep him warm.

For several days he had to be fed every three hours around the clock. When he was able to recognize the approaching dropper, he would squeal until the milk stopped the noise! Al thrived on the mixture and grew in strength daily. As his teeth developed, shelled nuts, raw carrots, and almost any kind of green vegetable were added to his diet.

Now he gets whole nuts plus fortified milk and vegetables. That his teeth are sharp we know from experience. He is loyal only to his friend and feeder and makes fierce "chirrrs" at anyone else. He ranks in size with the largest grays, and his coat and tail are magnificent.

The photographs show his method of returning to his bed while young. After eating until his abdomen resembled a golf ball, Al would jump from a hand to the wool sock, go down to the toe, turn around, and pop his head out of the top.

Contrary to the opinion of some authorities, we have found that it is possible to raise gray squirrels from tiny babies to maturity and have had excellent results with four grays found when they were about three or four days old. Raising gray squirrels requires patience and slow gentleness, but the results are very rewarding.

Hiram L. Parent
Madison, Conn.

∘ ∘ ∘ ∘

Sirs:

As a new reader of Natural History, may I offer you my compliments on an attractive, readable publication . . .

H. S. Schein
Louisville, Kentucky.

▲ Al, possibly the abandoned runt of a litter, was raised to sturdy adulthood on milk and Viosterol

▲ He would jump into the sock, go down to the toe . . .

➤ . . . and turn around to pop his head ou

Continued from page 351

dayandi, or blood compact. Two traditional enemies, such as a Bagobo and a Moro, decide to become friends. Each cuts his wrist until the blood flows freely. Then each drinks the other's blood, signifying that they are henceforth blood brothers.

We came out of the jungle at last into the frontier town of Malagos. Here Ranon insisted that we remain at least one night as guests in his house.

Ranon's house, although it consisted of only one room, was so large that it seemed like an auditorium or a theater. The sleeping platform across one end of the room resembled a stage. Alcoves down one side of the room were like theater boxes. The walls were covered with booty captured on Ranon's many raids into enemy territory. There were many masterpieces of native workmanship – spears, shields, drums, copper gongs, jars and plates, beaded clothing, baskets. Also there were a few things from the outside world. A favored position was given to an advertisement of an American brewery.

It was late and, after eating, we were shown to their quarters – the stage. We had the sleeping platform to ourselves, while Ranon and his wives occupied one of the alcoves, and no more nor less than 22 of the magani's immense family slept on the open floor. Surely there was never a more public bedroom. But publicity did not inhibit Ranon and his three spouses, judging by the sounds that strayed from the alcove. After all, he had been gone a long time.

Lieutenant Alivolo came in the morning. He was stationed in Malagos as an officer of the Constabulary. He helped me to pose photographs of Ranon and his family, and he interpreted while I plied Ranon with questions concerning his domestic affairs.

It developed that Ranon had had seven wives, but four had died. Whether he had been instrumental in the demise of any of these four, we did not learn. The Lieutenant explained that, under Bagobo custom, it was perfectly ethical for a husband to kill an unfaithful wife and her admirer as well, and count these two deaths to his credit as a magani.

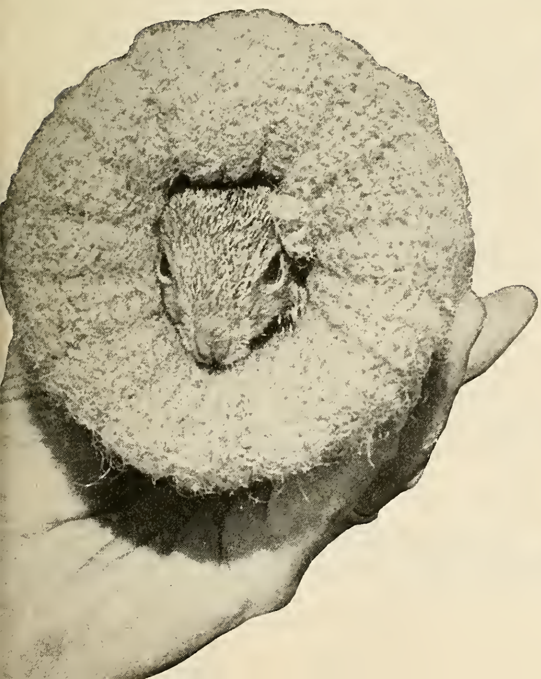
Besides his wives, Ranon had fourteen slaves, taken prisoner on his various raids. The Lieutenant explained that slavery is a loose institution among the Bagobos. The children of slaves are free, and even the slaves themselves frequently marry members of the ruling tribe.

I asked what there was to stop an aspiring young chief from donning red even though he had not killed the required quota.

Ranon looked shocked. "The spirits would make his body swell and turn yellow," he said, "and he would die."

"What is the largest number ever killed by a magani?"

"Three hundred," said Ranon. "It was when I was a boy. The Bagobos and Atas were deadly rivals. They tried to outdo each other in killings. One Bagobo warrior and one Ata excelled all the rest. One would be ahead for a little while, and then the other. The race lasted for five years. Finally, when each man had a record of three hundred deaths, they agreed to stop. They performed the ceremony of *dayandi* and became blood brothers."



▲ AL's milkbottle was an old medicine dropper

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Continued from page 343

The work comprises ten chapters, appendices concerning specifically identified and banded birds, a bibliography, and an analytical index. The photographic illustrations are not only of the highest standard but are also all pertinent to the scientific discussion.

Richdale's monograph is a notable and original ornithological contribution. Whatever is written on penguins hereafter will have to take its base line from this source. There is perhaps no paper in the history of science that has involved such continuous, intimate, and long-term recording of the behavior of a wild animal. Throughout ten years the author seems to have made of himself a penguin with a human brain. On one page he writes: "Between 15 December, 1939, and 5 February, 1940, I camped within a few meters of the nest of the male Z 12 and his mate 115." The context then reveals that he had remained in his observation tent day and night for 52 consecutive days, without ever moving more than a few yards from the spot. Friends who have known him in the field can readily picture the almost incredible vigil, with Mrs. Richdale driving down at frequent intervals to bring food and dry clothing to her consecrated naturalist beside the yellow-eyed penguin's nest!

The book bristles with stimulating results of inductive reasoning brought to bear upon voluminous records of observation. For instance, Richdale shows how the determination of the sex of one penguin that he found dead enabled him to establish, without possibility of doubt, the sex of 59 others in the same colony. This, of course, was because he had banded every one of the residents and had followed their pairings and occasional changes of mates through a series of years.

One could write at great length upon the brilliant exposition of bird behavior in this study. Its usefulness to investigators in other fields is enhanced by the excellent summaries that terminate each chapter.

R. C. M.

THE WEST OF ALFRED JACOB MILLER (1837)

FROM THE NOTES AND WATER COLORS IN THE WALTERS ART GALLERY WITH AN ACCOUNT OF THE ARTIST

----------by Marvin C. Ross

University of Oklahoma Press, $10.00,
254 pp., 200 illusts.

IN a country that has developed as fast as the United States, it was perhaps inevitable that the tide of change and growth should have encouraged and then swept away occupations so rapidly that even their memory has almost disappeared. In 1837 this country saw the peak of two such episodes. In New England, whaling was in its heyday, sending forth its small vessels to all corners of the Atlantic and Pacific and bringing wealth to the owners in their white houses in Nantucket, Edgertown, and New Bedford. In another ten years this hardy, adventurous way of life would begin to disintegrate as kerosene brought a cheaper source of illumination.

In that same year in the Far West men carried on another occupation, equally hazardous and doomed to an even quicker death. The beaver-trapping mountaineers of the Rocky Mountains were supplying the fur markets of New York and London with their peltries. Huge fortunes, among them Astor's, were being accumulated in the trade. A generation of these intrepid men and the whole thing was over. But while it lasted, the fur trade created a rich, colorful, and highly indigenous form of American life. The difficulties were many. The rugged and severe terrain demanded a high degree of skill and resource to survive. The dangers of the hunt were often fatal, and the Indians only recently in contact with the white man were a constant and devastating threat. To this often grim but basically free and attractive existence, Captain William Drummond Stewart was drawn in 1833. He was a Scot, a soldier, a sportsman, and heir to landed estates in Scotland. For six years he lived among the trappers, traveled with the supply trains, hunted buffalo and bears, and observed the Indians. In 1837 he took with him Alfred Jacob Miller, a Baltimore artist, to record the scenes he came to love and wanted reproduced for his home in Scotland.

Miller made a large but unknown number of sketches during his summer's trip, which were to serve as notes for subsequent more formal renderings. Many of these sketches were copied again and again to order. After his death at the age of 64 in 1874, he was quickly forgotten, just as was the West he had portrayed. Now that general interest in this period of our history has revived, all sources of information on that epoch have acquired renewed value. Miller's sketches are especially valuable. They represent a pictorial rendering of men and things that have all the authority of contemporaneity. They are accurate even in minute detail. And besides all that, they have charm.

The collection, beautifully reproduced here in black and white, consists of 200 water-color sketches, now the property of Baltimore's Walters Art Gallery, together with the comments that Miller wrote on each of them. This is a major contribution to the record of American history.

HARRY L. SHAPIRO

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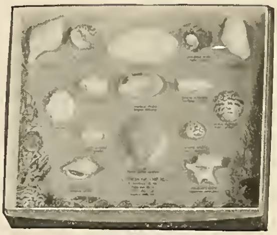

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LETTERS

Penguins are Southerners

Sirs:

My young son, in the fourth grade, asked me why there are no penguins at the North Pole, but I was unable to find an answer in the encyclopaedia. We subscribe to Natural History and enjoy it very much, but rather than wait for an article to appear on penguins, I thought that your files might yield some information on this question.

Shailer L. Bass

Midland, Mich.

The following remarks are offered by Dr. Robert Cushman Murphy of the American Museum's Bird Department:

This question is not as simple to answer as it may seem.

The reason why there are no penguins in the Arctic may be merely that the birds of this family have never reached that part of the world. Penguins are, presumably, of Southern Hemisphere origin. It is at least possible that the early stages of their evolution were on the Antarctic Continent itself during a period in the past history of the earth when the climate was milder around the South Pole. All the fossil penguins of which we know belong to such Southern Hemisphere areas as Patagonia and New Zealand. The sixteen or seventeen species of living penguins are also Southern Hemisphere birds, although several of them reach the tropical belts and one species occurs on the equator at the Galápagos Islands.

An additional northward journey would still require travel across thousands of miles of ocean water in the Northern Hemisphere. Throughout much of this expanse, food suitable for penguins would be scant because warm ocean water contains much less life than water of low temperature. Then, by the time the wandering penguins had reached the richer Arctic waters, they would find competition from an extremely abundant population of many kinds. The auks, murres, guillemots, puffins, etc., are all members of a single family confined entirely to the Northern Hemisphere, just as penguins are confined to the Southern Hemisphere. The auk family is indeed more or less analogous to the penguin family, even though the relationships are not close. One auk, namely the extinct great auk, was a flightless bird and was originally called "penguin." This is the "penguin" of the famous novel by Anatole France.

And finally, the penguins would not last long in the Arctic even if they should reach it. They are flightless birds, and when they came ashore to nest, they would speedily be wiped out by the wolves, foxes, bears, weasels, and other predatory mammals that occupy most Arctic lands. The Antarctic Continent and the surrounding islands have never been reached by land mammals, which is one of the principal reasons why the penguins have been safe for long ages in that isolated part of the world all around the Southern Pole.

On the Crowninshield Elephant and Old Bet

Sirs:

Dr. R. W. G. Vail, Director of the New York Historical Society, tells me that history fails to disclose what became of the Crowninshield elephant—the first elephant ever to come to America, whose career I outlined in last month's Natural History. Since she had no need of a Christian or pagan name to distinguish her from others of her kind, she was known as *The* Elephant, though it is possible she may have been the Learned Elephant or the Little Bet killed on July 31, 1822, at Chepachet, Rhode Island.

Old Bet, according to Dr. Vail, was the second elephant to come to America. She was an African elephant, purchased by Bailey's brother, a sea captain, in London, 1815, for $20 and sold to Hackaliah Bailey for $1000. This is the elephant recorded by Bentley as killed July 26, 1816 in Alfred, Maine.

George G. Goodwin.

American Museum of Natural History,
New York, N. Y.

"Enjoy Them While They Last"

Sirs:

I want to congratulate you on the fine article in the September issue entitled "Enjoy Them While They Last," by Ben East. This is the kind of writing that does some good. . . . Your magazine covers such a broad field, it's wonderful.

Mrs. C. C. Marshal,
President.

Natural History Club,
of New York City.

Sirs:

If you have any reprints of the article "Enjoy Them While They Last," by Ben East, I would appreciate your sending me a few.

Thomas Parker, M. D.

Greenville, S. C.

Sorry, we haven't any.—Ed.

Sirs:

The September issue was excellent. . . . I hope the appeal to save the wildlife of Alaska, which was most moving, has a strong effect.

Mrs. Bradford Young.

Manchester, N. H.

Sirs:

I would like to congratulate Ben East on his excellent article "Enjoy Them While They Last," which appeared in the September issue of Natural History Magazine. As an outstandingly factual account of shore bird slaughter in North America, it makes a strong address both to reason and to the emotions. However, I feel that the article loses considerable force as an appeal for the protection of vanishing Alaskan wildlife because it fails to include certain essential information. Would you, therefore, be so good as to answer the accompanying questions?

John D. Battenberg.

St. Louis, Mo.

The questions follow, with answers by Richard H. Pough of the American Museum's Department of Conservation:

1. **What is the agency that manages Alaska's wildlife resources?**

The Department of Interior, through its subdivision known as the Fish and Wildlife Service.

2. **Does it have the necessary full authority to make and enforce regulations governing open seasons and bag limits for all species of Alaskan wildlife?**

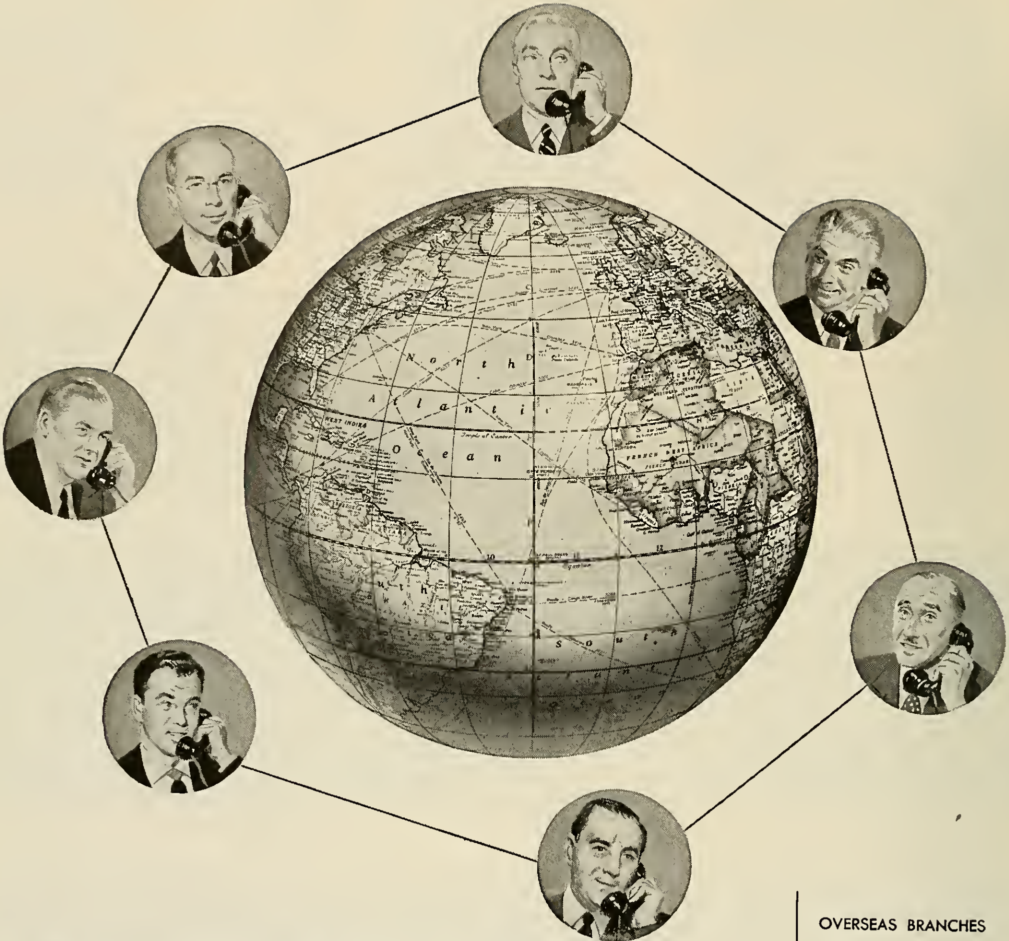
Yes.

3. **If so, why is excessive shooting legal?**

Excessive shooting is not legal except insofar as Section 46.31 of the Regulations Relating to Game and Fur Animals, Birds, and Game Fishes in Alaska may provide a loophole which would permit legal killing in areas where the wildlife is not abundant enough to tolerate any kill. This Section reads as follows:

"For emergencies only. An explorer, prospector, traveler, Indian or Eskimo may, when in need thereof and other sufficient food is not available, take animals, birds (except migratory birds), or game fishes in any part of the Territory at any time for food; but he shall not transport or sell any animal, bird, game fish or part thereof so taken; and an Indian or Eskimo may take, possess, and transport, at any time, auks, auklets, guillemots, murres, and puffins and their eggs for food, and their skins for clothing

Continued on page 431



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NATURAL HISTORY

The Magazine of the American Museum of Natural History

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VOLUME LX—No. 9 **NOVEMBER, 1951**

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One of the most spectacular performers of our southwestern deserts

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A National Monument dedicated to peace where Indians secured the red pipestone for their ceremonial pipes

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THE COVER THIS MONTH

The man we see on the cover lives in the Saintes Islands in the French West Indies. He is a fisherman and is wearing the typical working costume of this trade. His clothes, especially his *salako*, or hat, are copied after the Annamese style of Indo-China. His hat consists of a bamboo frame covered with dark material on the underside and white cotton on top. Although these hats are usually worn by men, sometimes a young man will make a frame for his girl, who may trim the inside with a cotton print and add some ribbon to make herself an attractive hat.

To make the market, Saintes Island fishermen rise before dawn and do the major part of their day's work before eight o'clock. In groups of two or three, they row out against the trade winds seven miles to their fish traps and pull them up from a depth of 30 feet with a vine. Then they poke the fish out with long sticks and return to the beach. The local buyers take their catch to the capital of Guadeloupe before the city customers finish their shopping.

Turn to page 420 for other photos.

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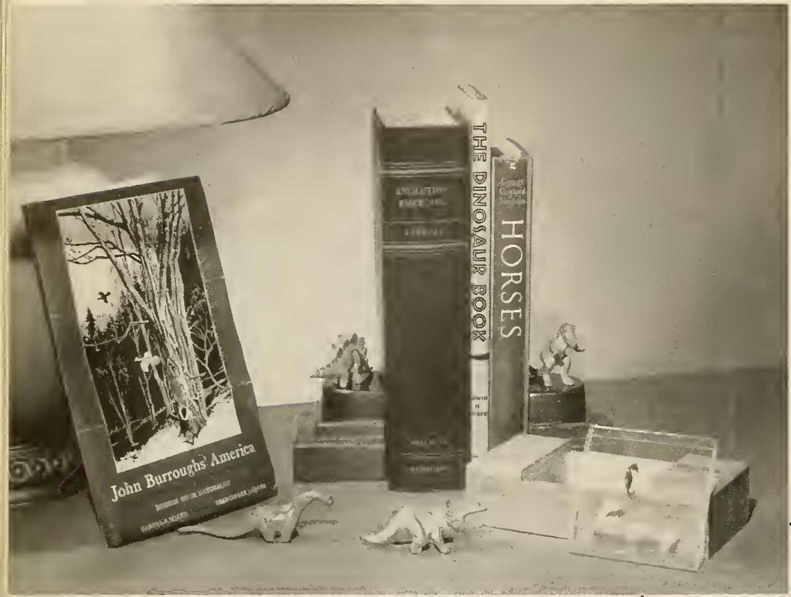

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The present volume is a much revised and expanded version of his second book on space travel: *Rockets and Space Travel,* which was first published in 1947.

This book covers three phases of the subject: a historical review from the time of the ancient Chinese to the present, a clear explanation of the major problems involved at the present time, and an intelligent preview of possible future development in this field.

Readers who want to learn exactly where we stand today in respect to such possibilities as orbital rockets, unmanned Moon Messengers with telemetered instruments, and the possibility of three-step rockets that may some day carry a human cargo to the moon, will find the answers in this book. Mr. Ley also explains very clearly the fundamental difference between a projected trip to the moon and to another planet.

There are two appendices. The first contains important data on Rocket Airplanes. The second has numerous notes and tables that include, among other things, current information on rocket societies, the characteristics of various types of rockets, data on the number of meteorites striking the earth in a given period, the probable number of meteorite hits to which a rocket would be exposed in the vicinity of the orbit of the earth, etc.

In addition, there is a large chart in the back of the book that gives pictorially in color the physical characteristics of the earth's atmosphere. The book is well indexed and contains an excellent bibliography.

On reading this volume, some of us may come to appreciate the fact that in the field of rockets, missiles, and space travel, it is later than we think.

ROBERT R. COLES

RETURN FROM THE POLE

------- by Frederick A. Cook

Edited, with an introduction, by Frederick J. Pohl

Pellegrini and Cudahy, $4.50
335 pp.

DURING a few days, in 1909, Dr. Cook was the world's hero; for newspaper readers believed him at first when he told in Copenhagen that he had attained the goal of the ages, had reached the North Pole on April 21, 1908. He was feted by royalty, decorated by universities, received by mayors, and given the freedom of cities. But the immediate skepticism of a few of the experts soon spread to most of the experts and then to the general public. The University of Copenhagen acknowledged it had been hasty; the experts told each other and the public that to believe Cook's story of how he had attained the Pole was an overstrain on credulity. The two Eskimos who had been with Cook changed from support to opposition, retracted their earlier testimony, said it had been concocted and rehearsed, and told in its place a story that fitted known facts. The essence of it, insofar as relates to a polar attempt, is that none was ever made; that instead of a long journey over drifting ice, beyond the sight of land, there had been a coastwise sledge trip, thus southward instead of north, to the well-known game paradise of the Jones Sound district. The winter had been spent living on meat and concocting a tale.

That Robert E. Peary had reached the Pole on April 6, 1909, as told in his 1910 book, *The North Pole,* was in due course generally accepted. That Cook had made up a Robinson Crusoe yarn, told in 1911 in *My Attainment of the Pole,* was the conclusion of nearly everybody, including nearly all the reference works. When Cook's friends, in his name, brought one libel suit after another against the publishers and authors of encyclopedias, histories, and biographies, the suits were thrown out of court. The insufficiency of Cook's narrative, and of his explanations, is thus among the few issues in polar explorations that have been passed on by courts as well as critics. From the heights, Cook went to the depths, and finally to Leavenworth prison for using the mails to defraud—however, on an issue that had nothing to do with exploration.

Cook has always made friends. Peary liked him when he had him as surgeon in the Greenland Arctic in 1891-92; he was the most popular member of the Belgian Antarctic Expedition of 1898-99; in Leavenworth he was nearly or quite the best liked prisoner, with both inmates and staff. After serving only a part of his term he was paroled in 1930 and immediately began that pathetic try for a

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comeback which is represented by the present book. For we are told by the editor: "Dr. Cook wrote *Return from the Pole* in longhand, beginning it in 1930 and completing it in 1935 when he was seventy years of age."

The *Return*, by implication, wants the reader to take for granted that Cook reached the North Pole, thus in effect requiring that we consider as fact the story of how he got back from the Pole, though we had previously been unable to agree that he ever reached it. Nor is the time more propitious for acceptance now, in 1951, than it was when the *Attainment* came out—much less so, for in 1911 it seemed possible that Bradley Land (which Cook said he had seen near 84 degrees north latitude) might really be there. This was still thinkable when Cook finished the *Return* in 1935, and even when he died in 1940; but since then the locality has been crisscrossed by flyers in every sort of weather at all seasons, without any vestige being found of the mountainous land which Cook described and of which the *Attainment* has a photograph labeled "Bradley Land Discovered."

So the *Return*, as far as concerns the alleged polar journey, is neither science nor history. But, like Oscar Wilde's *Ballad of Reading Gaol*, it still may, as literature, help to rehabilitate its author. For the story that the book tells of what happened, really or pretendedly, during the winter in Jones Sound, has something of the Robinson Crusoe and Swiss Family Robinson quality—not probably for other explorers but possibly for readers who have never been to the Arctic.

VILHJALMUR STEFANSSON

BEGINNER'S GUIDE TO ATTRACTING BIRDS

- - - - - - - by Leon A. Hausman

G. P. Putnam's Sons, $2.00
127 pp., numerous spot drawings

IN this fully-illustrated little book Professor Hausman has brought together information on all the standard techniques for attracting birds and catering to their needs. He has enlivened this material with observations based on his own experiences with birds. In addition to the data on birdhouses, winter feeders, birdbaths, and the like, there is a key to some of the birds usually seen about feeding stations. This is accompanied by animated drawings of the birds. Another useful feature is a list of selected books and pamphlets on the various aspects of attracting, studying, and protecting birds. All in all, this book should prove to be a handy guide for the beginner who is eager to attract songbirds to his premises and to learn more about them.

DEAN AMADON

AS FAR AS THE YUKON

- - - - - by Florence Page Jaques, Illustrations by Francis Lee Jaques

Harper and Bros., $4.00
243 pp., 56 illusts.

THE writer-artist team of Florence and Francis Jaques have achieved here a pleasant chronicle, superbly illustrated, of a wandering over the continent. For Mrs. Jaques announces at the very outset that they went from New York to the Yukon by way of Texas.

As a matter of fact, they did even more than that. They returned from the Yukon to New York by way of Vancouver, the Delta waterfowl marsh in Manitoba, and the canoe country along the Minnesota-Ontario border, taking time for a side trip into the Canadian Rockies of British Columbia.

It is the story of this wandering journey that the book tells, simply and without any pretense at the dramatic, but with some very charming passages where the author deals with her favorite subject, the wild flowers she saw along the way.

The yucca-dotted plains of Texas, the Mariposa lilies of California, wild lilacs on Mt. Shasta, the tangled greenery of the Olympic rain forest, the bluebells and lupines of Alaska—these and many more play a major role in this story of a trip that was dedicated to the "collection of wild gardens."

There are also birds and small mammals, mountains and rivers, the narrow-gauge railroads that are of such great interest to the artist half of the team; and now and then interesting fragments of local history creep in.

As Far as the Yukon is a small story, flowing along pleasantly, brightened throughout by the understanding and warm affection in which the author holds wild places and wild things. It is only fair to add, however, that personally this reviewer thought the illustrations much better than the text.

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HOW TO KNOW THE AMERICAN MAMMALS

- - - - - - - by Ivan T. Sanderson

Little, Brown and Co., $2.50
164 pp., 25 color plates,
10 pp. of drawings

HOW to Know the American Mammals is designed to give the layman a colorful picture of the mammals living in America north of the Mexican boundary.

In a simple, straightforward manner, Mr. Sanderson gives his version of this interesting subject. There is an outline description of each distinct type of mammal, including its size, color, and habitat. The outstanding characters and specialized peculiarities in behavior of each are emphasized. There are short life histories.

Mr. Sanderson has done a very thorough job and covered not only all the North American land mammals but the whales, porpoises, and seals found in the neighboring seas. To aid in identification, he has included numerous illustrations of the mammals as he sees them and color plates by the famous artist Louis Agassiz Fuertes. He has an entertaining knack of making scientific names popular and easy to remember.

Many works on North American mammals have been published in recent years, but this is the first strictly popular reference book that has attempted to be scientific. It would be difficult to criticize anything specific about this work without checking every statement. Though I do not necessarily endorse all of Mr. Sanderson's statements, his findings are reasonably correct. However, there is a tendency to emphasize extremes rather than averages, which is often misleading.

George G. Goodwin

A FIELD GUIDE TO THE BUTTERFLIES OF NORTH AMERICA, EAST OF THE GREAT PLAINS

- - - - - - - - by Alexander B. Klots

Houghton Mifflin Co., $3.75,
349 pp., 40 pls.

THE North American butterflies, birds, and mammals are so thoroughly known to biologists that it is unlikely that more than half a dozen species of each remain unrecognized. Consequently the time has arrived when guides may be compiled allowing field naturalists to recognize every species in these three groups.

Dr. Klots has presented such a manual for the butterflies of eastern North America. He is a Professor of Biology at the College of the City of New York and a Research Associate of the American Museum of Natural History. He is a distinguished authority on North American butterflies, and it is not unexpected that

Continued on page 430

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Can we save the Gray Wolf?

By Edwin D. Neff

On the very borderland of extinction, the gray wolf stirs man with mixed emotions. Will hate or admiration for this symbol of the unconquerable wilderness win out?

It seems only yesterday that the late Ernest Thompson Seton wrote his story of that magnificent outlaw, Lobo, king of the wolves. He told how Lobo evaded every device of man—traps, poison, guns—for five incredible years. How he was finally brought down, heartbroken and the fight gone out of him, through the capture of his beloved mate, Blanca. It was Seton himself who finally trapped Lobo. But he must have realized that even helpless in the traps, the wolf was the true victor. For Seton, reflecting perhaps the compassion of all gallant men for the vanquished, could not kill him. And Lobo, refusing compassion, died, his eyes not on his captor but on the dusty reaches of the New Mexico valley that had been his hunting ground.

Today, Lobo is a symbol for all his kind, for the gray wolf is nearly gone from this country.

Stanley P. Young of the U. S. Fish and Wildlife Service, a top authority, estimates there are fewer than 1000 gray wolves in the United States, a dangerously low figure. And these 1000 are virtually restricted to the northern extremes of three States, Wisconsin, Michigan, and Minnesota, though there are larger numbers in Mexico, Canada, and Alaska.

Yet even on the borderland of extinction, the gray wolf breeds controversy. Cattlemen and hunters want no part of any scheme to protect him. Wildlife conservationists, fearing that an authentic figure of the American wilderness is disappearing, urge that controls stop short of extinction. But, as we shall see, the number of practical sanctuaries within this country are frighteningly few. Most people prefer to admire old Lobo in somebody else's preserves.

His principal enemy, not only today but throughout history, is, of course, the keeper of livestock. Yet bounties are hard to defend in states where livestock is of little economic importance. Sportsmen decry the gray wolf's attacks on game, yet there still are areas within this country where protected game has become so plentiful it is destroying its own food supplies. More consideration should be given to the value of the wolf as a control factor in the normal wildlife picture. In some regions, the wolf's damage to domestic stock might be greatly outweighed by his reduction of game out of balance with its environment.

The problem is clear, though by no means simple. Can a just plea be made for this animal, despite his past depredations, and is there any practical possibility of preventing his extinction?

Even if we had made no mention up to this point of the animal in question, the reader would have had good reason to wonder about him. What nature of beast is this that can stir up such controversy? Why do men hate him and at the same time betray flashes of reluctant admiration? Why could Seton devote every ruse to his capture, then find himself unable to destroy his prisoner?

The key to these questions is the nature of the animal itself. He is the very symbol of unconquerable

AMNH Photo

▲ **Midnight** in midwinter on Gunflint Lake in Minnesota: Eastern Timber Wolves in an American Museum habitat group. The northern lights cast their eerie glow over a scene that has gripped thousands of visitors

forces. He gives no quarter, asks no quarter. Few men have tamed him. Though he is the ancestor of man's most devoted servant, the dog, he himself refuses servitude. Given any kind of odds, he can outsmart, outfight man. And throughout this country's history, man has been his worst enemy. Man killed off the wolf's natural food source—game. Then nothing remained but for the wolf to attack man's livestock. And when this happened, man trapped him, poisoned him, shot him. Warfare against the wolf reached the point where his extermination was debated in the halls of Congress. Federal funds were voted to hire professional hunters and to pay learned scientists to plot against him.

Still, hunted and hated, the favorite object of man's wrath, the gray wolf fought on. He trotted deftly around the traps; he sniffed contemptuously at poisoned carcasses; he stayed beyond the range of guns. And in the predawn stillness of the shrinking wilderness his stirring howl indicated to the apprehensive settlers the wolf's indifference to man. Yet man finally won. Or rather his money, his weapons, and his science won, driving the wolf into a comparatively few acres in the northern extremes of the states we mentioned. Once, he had roamed nearly the whole continent, even to within less than 500 miles of the North Pole itself. In the North, the wolf has yet to experience the systematic campaigns of extermination practiced in parts to the south. But from Arctic America come complaints of wolf concentrations, wolf predation, and the initiation of systematic poisoning. And one suspects it may be only a matter of time before even these northern wolves may be on the list of animals threatened with extinction.

The story of this battle to survive is as romantic as the gray wolf himself. But before we begin, let's take a closer look at old Lobo. In general he physically resembles a German Shepherd dog and has a thick coat of hair. Despite the term "gray," individual gray wolves may be almost any color between white and black. Scientists believe these color variations may be due to variations in light, temperature, and humidity in different parts of the continent. Size too, varies. Weights range between 60 and 175 pounds, though the latter size is found only in Alaska and the Mackenzie River country in Canada. His shoulder height may be between 26 and 38 inches.

His efficiency as a hunter stems from a combination of strength, endurance, and exceptional cunning. There is a story of an Arizona female wolf who dragged a seven-pound trap through more than six miles of dense thicket, keeping well ahead of the unencumbered dogs pursuing her and finally doing grim battle with two of the dogs before their master shot her. A Canadian archbishop told a far more amazing story of a black wolf who dragged a steel trap and the wooden block to which it was attached for 90 miles through snow and in bitter cold for 30 days, apparently without food. The wolf was a walking skeleton when finally killed.

Stories of the gray wolf's speed are probably exaggerated. He has been clocked at 28 miles an hour, and while he doubtless can do better for short distances, his famous distance-eating lope is about half that speed. However, he can keep up a steady pace all night.

Wolf hunters say it is not speed but this great endurance that helps to make the gray wolf such a formidable predator. Many of the larger four-footed animals can outspeed the wolf for short distances, but he can run longer. He is not a sprinter but a distance runner, and his patience is infinite.

Even more impressive than these stories of endurance are the examples of his cunning. Newfoundland hunters tell how wolves actually seemed to conspire against their prey. Coming upon a herd of deer, the wolves would divide, a few hiding along the deer trail, while others slipped around to the windward of their prey and chased them into the trail, where they were pounced upon by the hidden wolves.

Stories like these seem to show that the wolf can think himself out of specific situations and is not dependent entirely upon instinct.

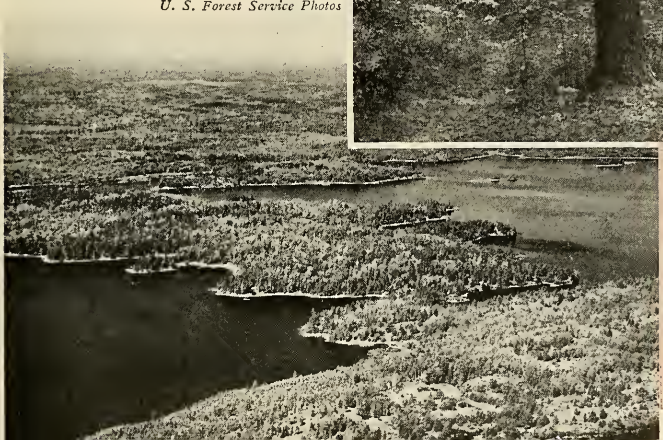
The wolf, like all other powerful carnivores, is a capable and ruthless killer. He employs his powers in the most efficient manner, and when there are several wolves in a group they may attack a large animal from every side. If hunting has been poor and the wolves are ravenous, some of them may actually begin devouring an overwhelmed animal before it has died or while it is yet being killed by other members of the pack. Stories told of the ruthless technique of the wolf probably illustrate the extremes to which this predator may go upon occasion, but in the majority of instances the wolf presses for an immediate kill, with few, if any, unusual practices.

Much has been written of the wolf's single-minded devotion to his mate and his family. Unlike most animals, the wolf mates for life, and the young remain with the parents until two or even three years of age. The whelps are born during early spring in dens. By late summer or early fall, when their teeth are coming along, they are taken out to the hunting runway to learn their trade. At first, the parents bring food to the youngsters at resting points along the runway. Later, the youngsters join in the hunt and are taught the technique of the kill. This technique and the hunting methods require co-operation; hence, the family sticks together and may even take on a few stragglers.

There are many stories of this devotion. Lobo's love for his little white mate Blanca is perhaps the best known. His determination to find her after she had been trapped and killed led him straight into an ambush he most certainly would have avoided otherwise and, indeed, had avoided many times. But with Blanca gone he lost his cunning.

Young tells of a reverse situation in which a female, seeking her trapped mate, never missed a night searching the area where he had been caught. After two weeks, she herself was trapped not 20 yards from the spot. In another instance, a wolf family tried to free a trapped

U. S. Forest Service Photos



TYPICAL WOLF COUNTRY in Minnesota, one of the three states to which the wolf is now practically restricted. *Above*: a scene in Chippewa National Forest. *At left:* aerial view looking northward across Sucker and Birch lakes into Canadian territory member by overturning large stones on the snare. The captive wolf couldn't have done it, for both his forelegs were held by the trap.

It is this trait of sticking together that probably has created the myth of the wolf pack, popularly supposed to number in the hundreds. There are early American woodcuts showing a pack of at least a hundred wolves surrounding a log cabin in a forest clearing. The fact is that while several wolf families will band together for a short time, the number is never very large. The usual wolf "pack" consists of a family group and perhaps a few strays.

Another legend is that of the "lone wolf." Young believes "lone" wolves are simply animals grown too old to run with the younger ones, animals whose teeth are too far gone to enable them to fight effectively. These lone animals will follow the others at a distance, eating game they have left. When the old wolf's teeth are gone, he dies, for they are one of his principal weapons.

In his prime, the wolf has perhaps the most powerful bite of any creature near his size. A wolf can take off the tail of a yearling calf at one snap, and there is a case on record where a wolf killed a calf with a single crunch of his muscular jaws, dividing its spine. A male wolf, trapped by a hunter in southern Arizona, severed a two-inch juniper limb with one terrible slash. The hunter was using the stick to push a can of water toward the wolf. Suddenly, the animal struck out like a snake.

"Another inch or two," the hunter recalled the other day, "and he would have taken the calf out of my leg, or maybe snapped off the leg itself."

No wonder then that men have always feared and hated—and admired—the wolf, have fought him with every means at hand in nearly every corner of the globe. In America, it was often a battle for survival. For in a new country, both man and wolf depend first upon wild game, then upon livestock. The battle between men and wolves in this country began almost with the first settler. Indeed, the first reference in our literature seems to have been made by Captain John Smith, that colorful adventurer of England and Virginia, in 1609, the very year that livestock was first brought to Jamestown from the mother country. From that time on, the warfare with the "master predator" was one of the grimmest battles the colonists had to fight. As early as 1630, the wolf had become an outlaw in Plymouth Colony, and two years later the Grand Assembly at James City placed the first bounty on wolf pelts. And bounties still remain in many states.

The Proceedings of the Worcester (Mass.) Society of Antiquity tell how wolves attacked "greatly to the annoyance of the settlers, and many a time did they start in the middle of the night to defend their pigpens and sheepfold, the brave housewife joining in the combat."

George Washington, confronting the same problem that had troubled John Smith more than a century before, speculated that sheep raising might have been one of the most profitable colonial investments except for wolves and wrote to England for advice. Alas, the English experts, unable to visualize America's vast distances, could not understand why the colonists could not fence in their flocks as was the custom in England's tiny pastures!

The war with the wolves continued on through the seventeenth, eighteenth, and nineteenth centuries as the settlers pressed on across the Alleghenies and the vast Mississippi basin and into the Far West. And there a curious thing happened, perfectly illustrating the two sides to this story. In the West, the principal prey of the wolves had been the buffalo hordes. But when pioneers discovered that the grasses of the western plains were ideal livestock feed at no cost, they killed off the buffaloes and substituted their sheep and cattle. That brought them in direct competition with the wolves, for these predators now had no food left except that belonging to man. In the eyes of nature, livestock now became the legitimate prey of wolves.

It was a war to the bitter end. In early Oregon, the famous "wolf meetings" were held. Settlers who could agree on nothing else banded together to plot against the wolf, and from these meetings grew Oregon's Territorial Government. Hence this mighty animal shaped Oregon's history.

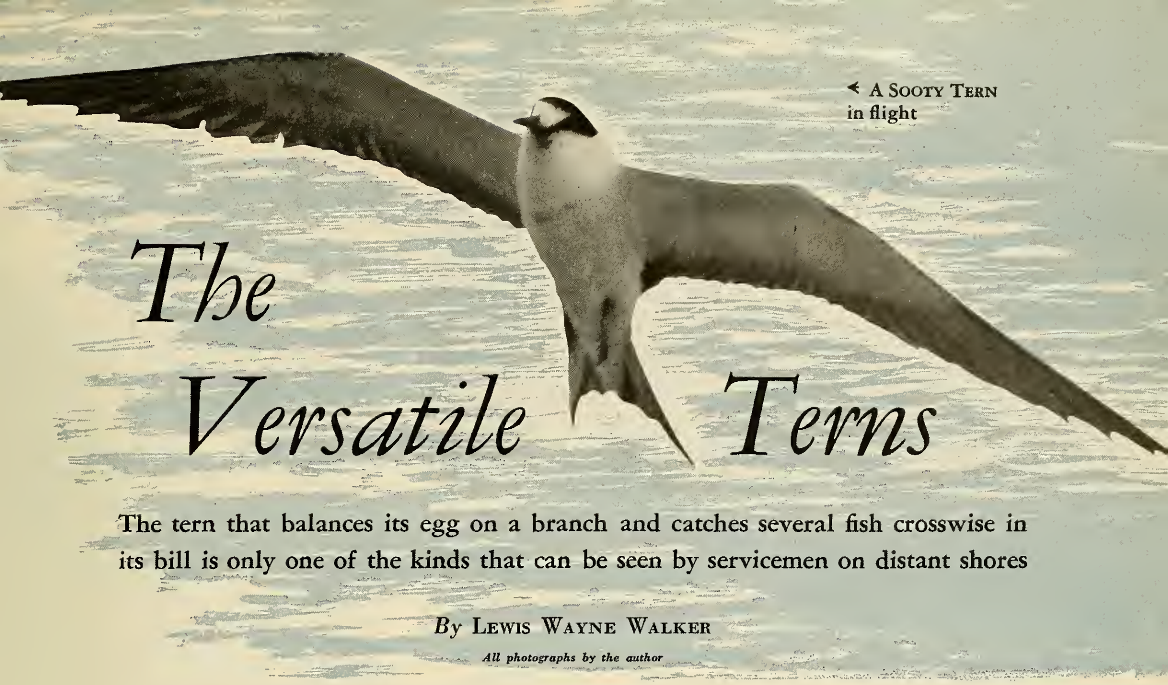
Guards, guns, traps, bounties, and poison were arrayed against the wolves. At one time, the use of strychnine reached the point where no rangeman would pass a carcass of any kind without loading it with poison. Cattlemen bought deerhounds and greyhounds to hunt wolves, burned thickets where wolves hid, and formed associations to raise big bounties.

Still, the wolf fought on. The cattlemen had destroyed his buffalo prey, but livestock was easier game, and the wolf prospered. After the turn of the century, frantic livestock men turned to the Federal Government for help, and in 1915, on the eve of war with Germany, Congress took time out to appropriate $125,000 to fight predators. The Federal battle began mainly within the National Forests, but later appropriations covered the grazing lands.

The appropriation of 1915 brought the U. S. Biological Survey, then under the Department of Agriculture, into the picture and thus began the first scientific approach to wolf extermination. The scientists soon turned up new wrinkles. One of the most effective was to kill wolf whelps in their breeding dens. The whelps were literally dug out of the dens and destroyed. The Federal men also discovered that the scent of strange wolves seemed to cause the animal to lose its head. Traps bearing the scent of wolves captured far from the scene were found to have a deadly allure, so that normally cautious animals could be easily taken.

These techniques turned the tide. By the late '20's, the big gray wolf no longer was an economic problem, and the Federal co-operative warfare against him began to peter out. For a time, little attention was paid to the animal, but today there

Continued on page 432



◂ A Sooty Tern in flight

The Versatile Terns

The tern that balances its egg on a branch and catches several fish crosswise in its bill is only one of the kinds that can be seen by servicemen on distant shores

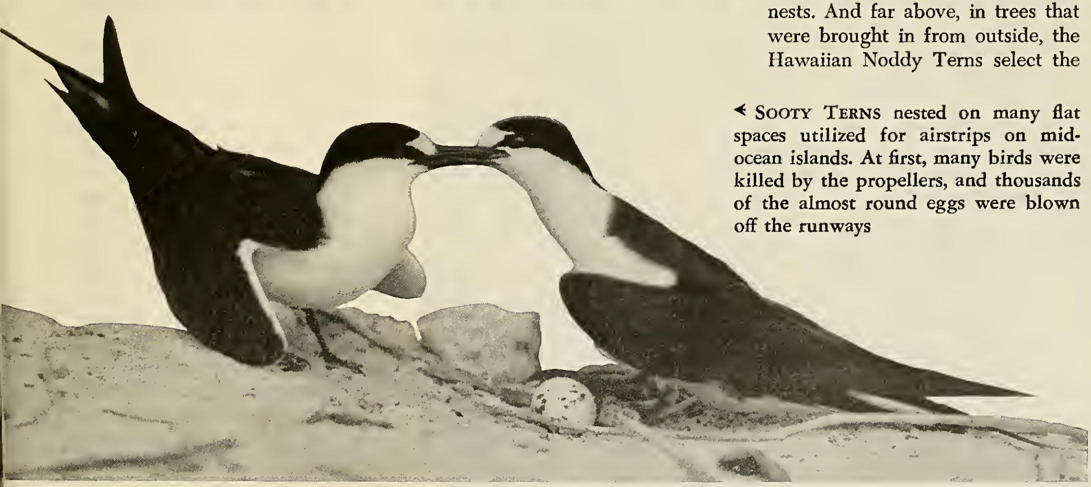
By Lewis Wayne Walker

All photographs by the author

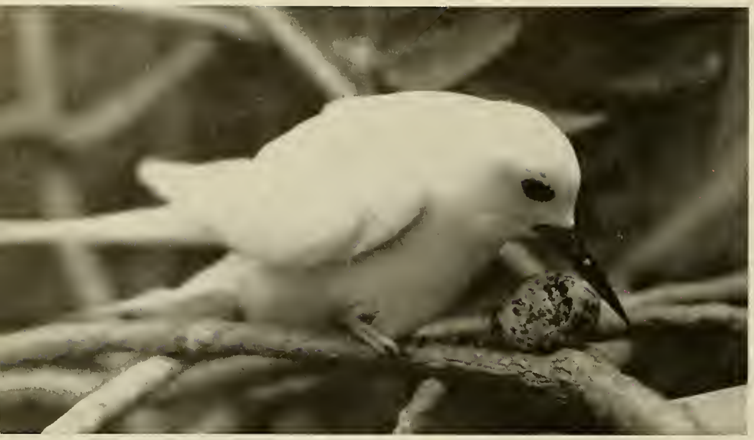
Any record holder is bound to garner a certain amount of publicity, and it is only natural that the Arctic Tern and its long migratory travels have often found their way into print. Ever since it became known that these birds nest within the Arctic Circle and winter on the fringe of the Antarctic, books on bird travel have called attention to this feat. Even in this age of jets, rockets, and guided missiles, the annual flight of Arctic Terns still holds more than passing interest.

There are other extremists among the tern clan. Each kind shows differences in behavior as well as in appearance—idiosyncrasies that prevent us from applying generalities in regard to foods, nesting, flight, and other traits. And some of these peculiarities, such as the nesting and fish-catching techniques of the Fairy Tern, have attracted special interest among laymen and bird lovers alike.

Midway, that tiny dot of land that was little known until World War II, has several species of terns that call the atoll home and return each year to its coral dust, bushes, and tall trees to raise their young. In some areas the bird population is so condensed that a tenement system is in vogue. At ground level the contrasty Sooty Terns scoop nesting hollows in the sand. Three to six feet above their teeming, screeching numbers, the Fairy Terns, most immaculate members of the tribe, balance their eggs on bare branches without any thought of protective nests. And far above, in trees that were brought in from outside, the Hawaiian Noddy Terns select the



◂ Sooty Terns nested on many flat spaces utilized for airstrips on mid-ocean islands. At first, many birds were killed by the propellers, and thousands of the almost round eggs were blown off the runways



▲ A **Fairy Tern** about to cover its egg, neatly poised in the fork of a branch. A gust of wind or the touch of a careless hand is sometimes enough to dislodge the egg

▼ A **Fairy Tern** with food for young

swaying branches and build their robin-like nests.

The Sooty Terns, occupying the ground surface of this two-dimensional bird city, have a tremendous range across the breadth of the Pacific and even on islands such as Ascension in the Atlantic.

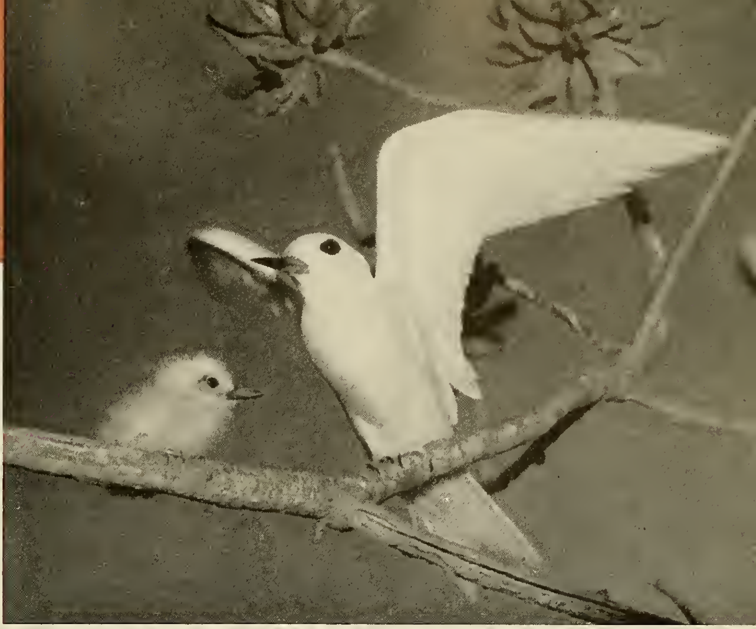
Many of these mid-ocean islands were needed as airplane bases in the last war, but unfortunately, aeronautical engineers and Sooty Terns both coveted the flat stretches. As a result, we had to deal not only with human enemies but also with feathered ones, for they swarmed upon the runways of many of our island bases. Exigencies of the times almost forced a war of extermination, and a few tern colonies on some of the smaller islands failed to raise any young during the five years of hostilities. The colonies of Midway fared better, and only the terns that persistently tried nesting on the long runway were eliminated.

In 1944, when I arrived on the island, the birds' adaptation to military life had made great strides. As our big transport plane hit the cement, we could see thousands of birds scattering on all sides but very few immediately in front of the whirling propellers. It was almost as though they had learned that this was a danger zone fraught with air currents they could not master. However, island servicemen had a different explanation. They said it was evolution. Some birds flew to the left, some to the right, and some straight ahead. The latter, they argued, didn't survive to pass the trait to their young.

Be that as it may, the moment our motors were stilled, Sooties returned like swarming bees and fluttered to eggs that spotted the ground at two-foot intervals. Some of the nesting depressions were under the wingtips of the transport, and on my first landing I noticed that the nearest birds were hunting aimlessly for missing treasures. At the time, I supposed they were tardy nesters, but a few days later a line of gray several hundred feet from the runway drew my attention. Investigation disclosed untold

➤ **An Adult Fairy Tern** and young

➤ **A Fairy chick** at the crotch where it hatched



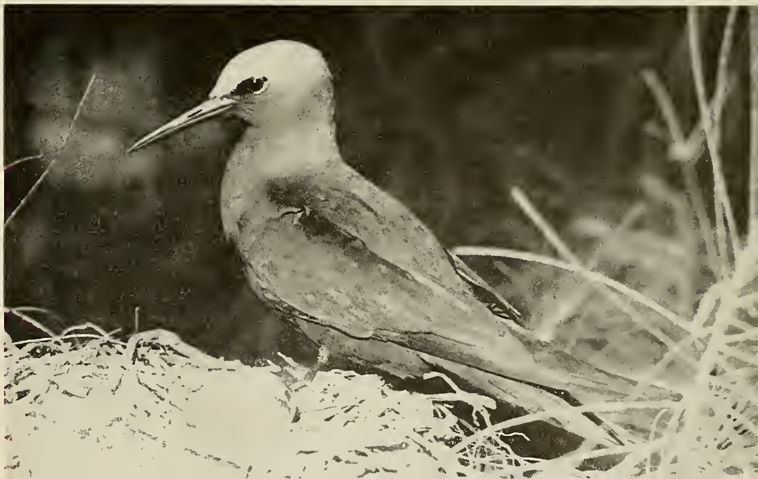
thousands of eggs lodged in a furrow in the ground where they had been blown by the planes! These eggs are almost round and do not enjoy the advantage of murre eggs, which are so lopsided they just roll in circles on the narrow ledge where they are laid.

Sooty Tern colonies create a patchwork quilt over Sand and Eastern Islands, the two that are surrounded by Midway's coral reef. Elsewhere there are messhalls, runways, and a native bush called Sceavilla. The bare branches of this plant are homesites for the Fairy Terns—strangest and most ethereal of the whole widespread tern family.

In comparison with the multitudes of other island dwellers, these "Jap lovebirds," as they were called by the service personnel, were not common. Although they were imbued with the social instincts of most terns, they rarely formed into colonies of more than a dozen pairs. This may have been due to a shortage of the specialized nesting sites. Unlike any other known bird, the Fairy Tern lays its egg on a bare branch! A few will take the precaution of choosing a crotch of a forked limb or the groove formed by two parallel branches. But you will see many that seem to defy gravity, and you wonder how long the egg could remain there if a light wind should rise. I have never seen any sign of nesting material used in the scores of homesites I have examined.

Before hordes of servicemen invaded and settled on these Pacific islands, few White Terns probably lost their eggs in spite of their peculiar nesting system. Whenever I observed Fairy Terns from a distance, they remained constantly on the egg, and it was obvious that the body and feathers of the incubating bird held it securely in place. When there was a change of shifts to relieve the bird on duty, the returning mate would take over with the least possible motion and loss of time. During the war, however, these birds were frequently disturbed.

➤ **The shy Hawaiian Noddy** is the only tern on Midway that really builds a nest. The upper branches of introduced evergreen trees provide the location, needles the material



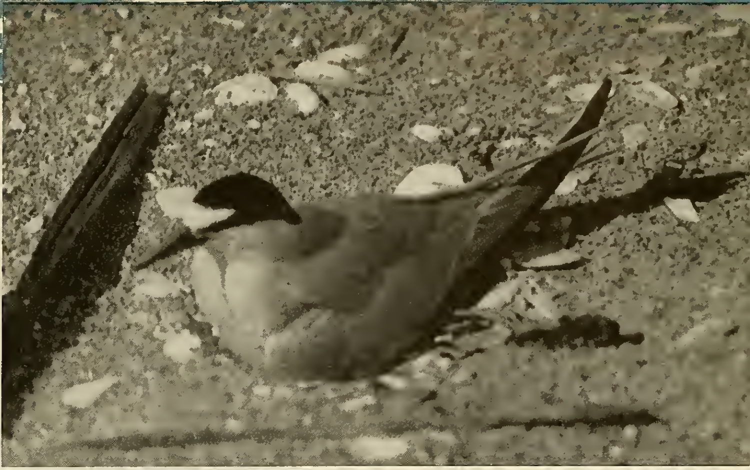
▲ Early in the century, Gullbilled Terns moved suddenly to the Salton Sea in Southern California

▼ On the Atlantic seaboard, insects had been the Gullbilled Tern's normal food. Here in the desert of Salton Sea, it has turned to eating lizards

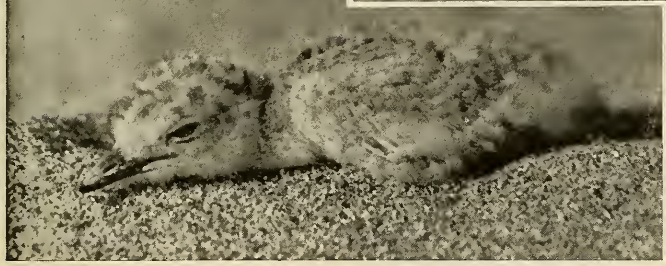
And when the bird was off the egg, servicemen learned that, alas, a mere touch of the branch would often cause the egg to roll from its precarious position.

All of the dozen or more species of terns that I have watched from photographic blinds bringing fish to the incubating mate or young always carry it crosswise in the beak. The White Tern is no exception, but instead of a single offering, this species will often arrive with a number of minnows neatly stacked in position. The system used by these terns to hold the first fish caught while making subsequent captures has intrigued naturalists for many years. Though not the first to observe it, a Marine adrift on a rubber life raft during the last

➤ A **Least Tern** on its nest at a beach near San Diego, California. Whole colonies, numbering into the thousands, were completely exterminated along the Atlantic coast



⮟ A **young Least Tern** "freezing" in the face of danger



war had a good opportunity to describe the process. When he was a few miles from an island, several Fairy Terns skimmed the water near by. Tiny fish, presumably frightened, lept out of the water, and the agile terns picked them off in full flight. Fairy Terns were originally thought to do their fishing by plunging beak-first into the water—a method that would make multiple catches a difficult feat.

Towering high above the Scaevola bushes of Midway there is a grove of strange evergreen trees, introduced to the island at the start of the century when the atoll became a station on our Asiatic cable line. The upper branches of these trees are the home of a flourishing colony of Hawaiian Noddy Terns—the only terns on Midway that really build nests. Observing Sooties, Whites, and Noddies, I was struck by their sameness. They are all unmistakably terns, and yet in their nesting they are as different as day from night.

The Noddy nests were fabricated from the pliable needles that grow on these trees, and the top surfaces were covered with needles so fresh they were still green. But the foundations of the nests were smeared with ancient refuse, intimating return and re-use each season.

Temperamentally, the Noddy Terns differed from their near-by neighbors, for they completely lacked the noisy brusqueness of the ground-nesting Sooties, as well as the extreme tameness of the immaculate Fairies. Instead, they were retiring and easily disturbed. This was a strange trait to be found on Midway, for almost every other species frequenting the island could be approached and photographed at close range without causing alarm. But the shy Noddy Terns flew from the trees when I began my ascent and failed to return while I remained in the branches.

The sudden arrival and the establishment of breeding colonies by birds that are not normally native to an area is not new in the science of

⮟ A **Least Tern** incubating eggs

natural history. As a rule, these wandering settlers encroach by slow stages and are probably motivated by a shifting food supply. But the Gullbilled Terns, now well established at the south end of the Salton Sea, didn't bother to make any slow transition. Early in the century they suddenly appeared on this body of water in the midst of a desert. In this new cactus-covered land, insect food, which had been their normal diet on the Atlantic seaboard, was almost completely forgotten, and desert lizards have taken the place of grasshoppers and cicadas.

The name "Sea Swallow" has been given to most terns because of their swift and graceful flight. But the ones that really warrant this appellation both for size and actions are the diminutive Least Terns, smallest members of the family. At one time these birds had tremendous colonies on the beaches and sandbars along both coasts of the United States. Like the egrets, however, they suffered ruthless persecution in the days when the feather trade was permitted to flourish. Whole colonies numbering untold thousands along the Atlantic coast were completely extermi-

▲ Royal and Elegant Terns in flight

▼ A Royal Tern incubating its eggs

nated. Some of the slaughter even reached the beaches of California and Mexico before laws were passed making possession of the feathers illegal. For many years thereafter, the fate of these small terns hung in the balance, and in some areas it was feared that breeding stock, necessary for a comeback, had been eliminated.

On a trip to Cobbs Island off the coast of Virginia in 1927, a party of five of us recorded only a few Least Terns; yet in earlier years the island had had a population that ran into the thousands. Our boatman on that trip told us how his father had described the piles of carcasses. Heaps of birds several feet deep were stacked near the boat landings, and each carcass had only the wings, back, and forked tail removed. By the early 1930's, some of the birds that had escaped death started to fan out and reoccupy their former range. The birds are now re-established on many of their ancient haunts.

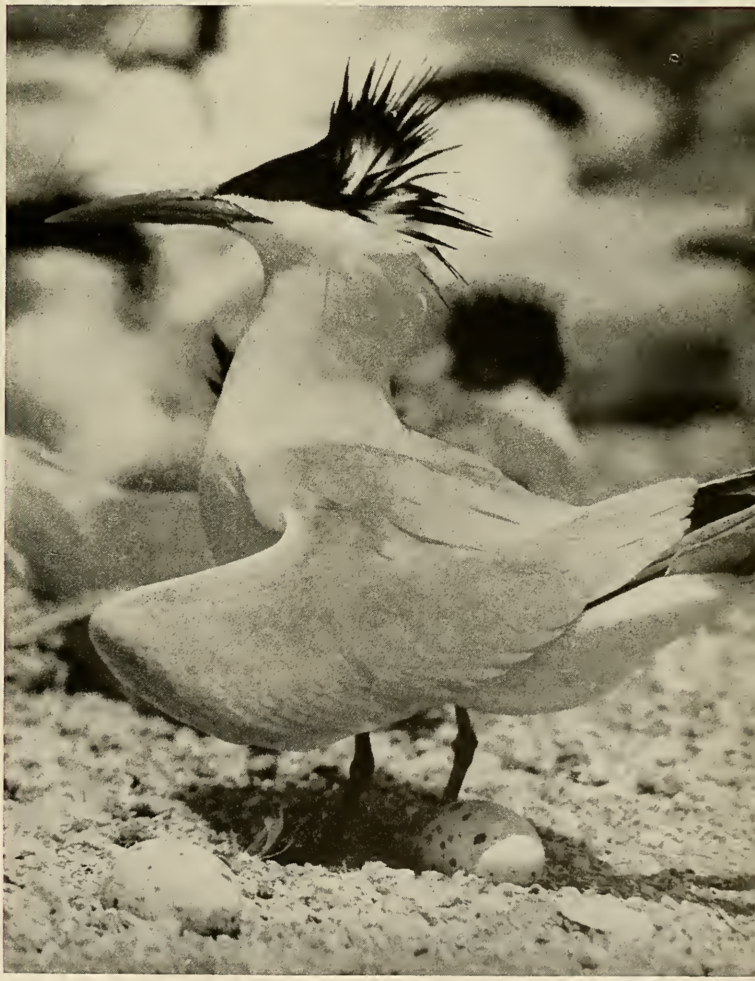
Along the Pacific shores of Southern and Baja California, Least Terns are a constant and familiar sight. During May and June they lay eggs and raise young on the dry sands lying behind beaches that are crowded with week-end throngs of humanity. Despite the hordes that tramp over their nesting grounds, the terns seem to fare well. On several occasions I have seen the adult birds drop to within ten feet of weiner-roasting picnickers and successfully feed their well-camouflaged young.

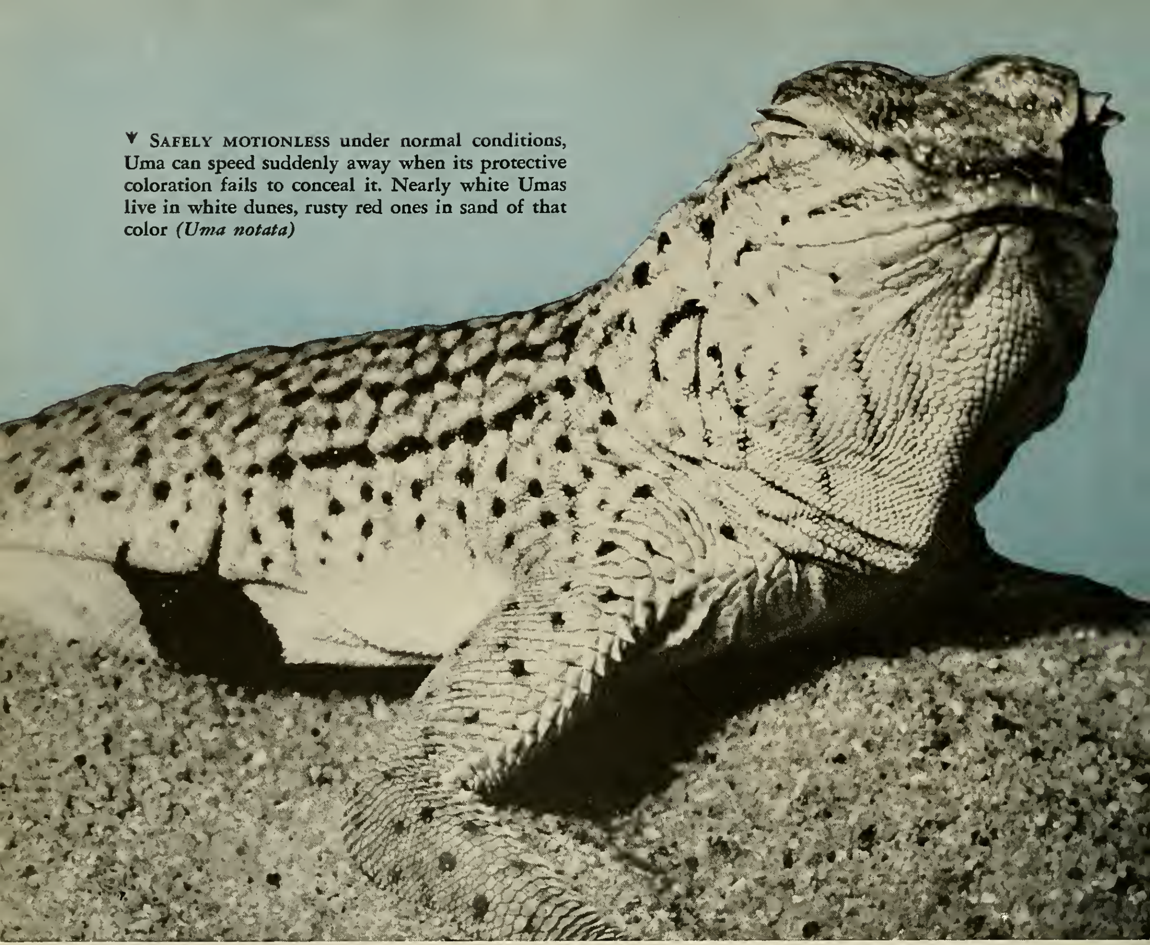
The nests in a colony of Least Terns are often 20 or 30 feet apart. It must not be supposed that the birds have learned to space their homes for safety from man. The habit is also evident where land enemies do not exist—on low, protected islands.

How different are the rookeries of the mixed Elegant and Royal Terns in the Gulf of California! These rarely visited colonies present a site almost impossible to describe. During the few weeks when the colonies are in full swing, the birds are packed so closely together that the ground cannot be seen between them. On some of the barren desert islands, the nesting areas cover acres of ground, and to a plane flying thousands of feet in the air they show up as silvery ribbons or circles.

A constant parade of Heermann's Gulls encircles these tightly packed masses of incubating terns, and whenever the opportunity for egg-stealing occurs, a waiting gull darts in and out and then dines at leisure. Throughout a day's time, these individual raids account for thousands of eggs, and by nightfall the diameter of the colony will have shrunk many feet. Darkness, however, brings more layers to replace and even extend the borders beyond the mark of yesterday. Thus through an accordion-like, pulsating growth the colony exists, with the terns on the outer edge unknowingly acting as buffers for the final benefit of the species as a whole. While they lay and are robbed and lay again, the birds in the center carry on their household duties, unmindful of the sacrifices being made in the suburbs of their settlement.

˅ **An Elegant Tern** over its egg in the Gulf of California. These terns pack their nests so close together in colonies with the Royal Terns that the ground cannot be seen between them





▼ SAFELY MOTIONLESS under normal conditions, Uma can speed suddenly away when its protective coloration fails to conceal it. Nearly white Umas live in white dunes, rusty red ones in sand of that color *(Uma notata)*

To most people, deserts imply heat and desolation — a stark world of barren mountains and forbidding sand dunes. The only living things seen by a casual visitor are the few small plants that seem half buried in the sand valleys. The surrounding sand hills stand ready to engulf even these few evidences of life. In sand dune areas a hawk may be seen soaring overhead or an occasional small bird flitting among the scattered bushes, but more likely no living animal will be noted on the dunes themselves.

But closer observation of the sandy wastes of our southwestern deserts will reveal numerous tracks in places not swept smooth by the winds. These indicate that many animals dwell in an area where the visitor least expects to find them.

As you walk between the dunes, you may see a puff of sand 100 yards away, as a small creature, running at high speed, disappears around the end of a dune. This excessively wary animal is Uma, the Fringe-footed Sand Lizard; and usually you will see no more of it than this first puff of sand. But if you follow the lizard's tracks, you will find that they stop abruptly on the slope of the dune. Place your fingers in the sand above this last track and rake down the dune face. The instant you touch the wily little creature you must grasp it or it will burst from the sand and be off, running on its hind legs and only occasionally touching its front feet to the sand for balance. When you capture Uma by this method, be careful not to pick up a resting sidewinder, for this small rattlesnake is often found partially buried in the sand.

Uma's method of burrowing is called "sand swimming." The creature dives into the sand, often while running at full speed, with its front legs pressed against its flanks. Lateral undulatory movements of the body and movements of the hind legs drive the animal into the sand; and rapid vibrations of the tail finally sink it completely. Most "swims" are short.

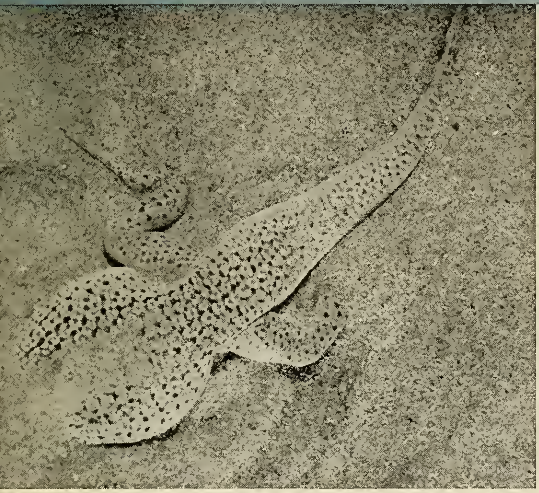
Sand swimming has added a third dimension to Uma's world, for the lizard is not restricted to living on the surface. Uma is remarkably adapted in several ways to its burrowing habits. Its tail and body are flattened, giving the animal a thin appearance when viewed from the

The LIZARD *that* *Swims in the Sand*

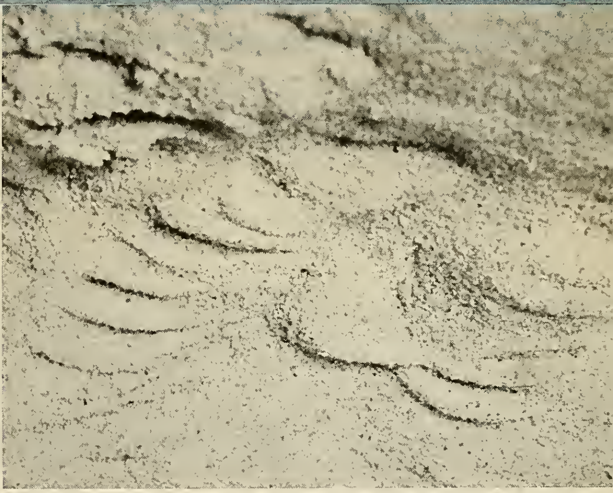
A puff of sand, a dive at high speed, and the Fringe-footed Sand Lizard disappears beneath the surface, in one of the most spectacular performances to be seen in our southwestern deserts

By Kenneth S. Norris

Walker Van Riper photos



▲ Caught in the act of diving, Uma reveals the secret of its disappearing act to the high speed electric flash camera. This photograph was taken at 1/5000 second



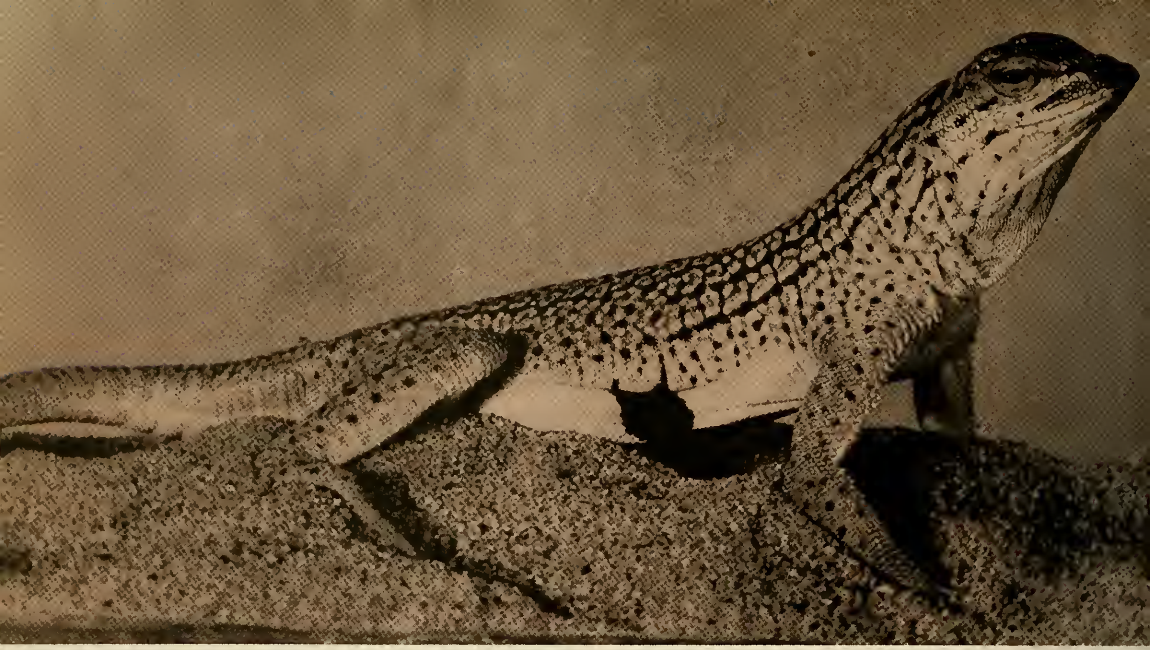
▲ Only a pattern of tracks reveals the whereabouts of the lizard. In burrowing beneath the sand, Uma was observed to make exactly the same movements a lizard makes when it swims in water—paddling with the feet and undulating the tail

side. The head is wedge-shaped and perfectly adapted for entering soft sand at high speeds.

Most animals without Uma's protective devices would find dune life rigorous because of wind-blown sand entering their eyes, ears, and nostrils. But Uma's eyes are protected by a series of scales called lappets, which fringe the edges of the eyelids. Under the sand, these are tightly pressed together, preventing the entrance of sand grains. Should sand enter, the grains become moistened and are rolled into a small pellet by movements of the eyes. A blood sinus in the corner of the eye becomes filled with blood and distends the nictitating membrane (present in man as the little knob in the corner of the eye) and thus forces the sand pellet outward. Uma removes the pellet with the toes of its hind feet, which are modified for this action. The nails are flattened, and the flat side only touches the eye, so the delicate eye surface is not scratched.

The nostrils can be closed against the entrance of sand by "valves," which may even permit limited breathing while the animal is beneath the surface.

A short hike through the dunes will be enough to convince most people that locomotion over soft sand is extremely difficult. Yet Uma attains speeds that are remarkable. One time, while driving over a



Walker Van Riper photo

▲ **Uma is not easy to see or photograph. If you search in the heat of the day, he will probably be resting quietly under the sand, with his nostrils and eyes closed against the entrance of sand. The "studio" sand in this picture is coarser than the lizard would encounter in its homeland in the Yuma Dunes of Imperial Valley, California**

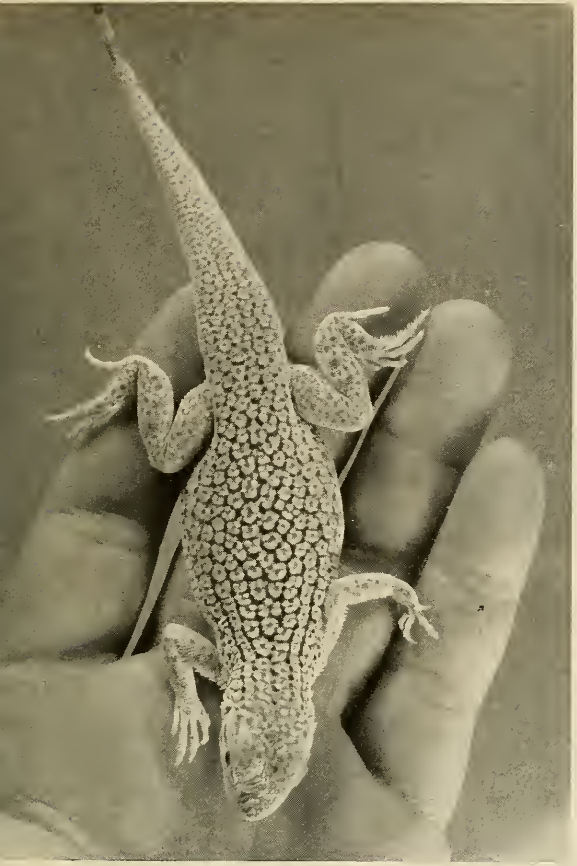
nearly level area of deep sand in a four-wheel-drive truck, a large Uma was frightened from hiding and ran in front of the vehicle. It was all I could do to keep abreast of the swift creature. My speedometer showed that this five-inch lizard was running fifteen miles per hour. At the end of the chase, I was able to pick up the exhausted animal by hand. Uma can run up 35-degree sand dune slopes at such speed that when the sharp crest is reached, you may see the creature shoot several inches into the air.

Uma's common name, Fringe-footed Sand Lizard, is taken from one of the structures adapting the animal for locomotion on sand. On its toes it wears "sand shoes," consisting of long, flat, pointed scales. When Uma runs, these fringes are forced outward and increase the toe surface, thus giving the animal better footing. Some of the toes of the hind feet are extremely long and serve to distribute the animal's weight over a large area, thereby preventing it from sinking into the soft sand.

In the dune areas, the smooth open stretches offer few places where an animal may forage in safety. Overhead, several species of hawks patrol the dunes for food, scanning the terrain with their amazingly acute eyes. On the sand, foxes, badgers, and snakes search for prey. Uma lives almost exclusively upon insects and has no weapons with which to combat these predators. Instead, it relies upon its fleetness, its sand swimming, and its protective coloration, which is truly remarkable. The color and pattern of the animal combine to make it all but invisible on the dunes. Nearly white Umas live in white dunes, and those living in rusty-red sand are so nearly the same color that it is virtually impossible to see them until they move.

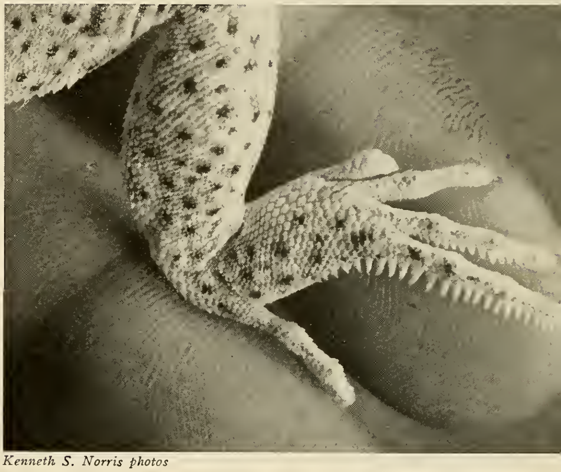
Much remains to be learned about Uma. One of its more perplexing features is the parietal eye. Just behind the level of the eyes, on the top of the lizard's head, is an enlarged scale, called the interparietal scale. In the center of this is a clear lenslike structure. Microscopic examination of this structure shows that it has many of the features of a true eye, such as a lens, fluid cavity, rod cells, and a retinal layer. The function of the parietal eye is unknown. Apparently it is sightless, and it has not been conclusively demonstrated that any nerve connections lead to it.

The notion that deserts are hot is often though not always true. The pursuit of desert animals during the day can be most uncomfortable and sometimes dangerous because of extreme heat. However, a little hunting on the dunes will show that lizards and most other animals do not stay in the sun but retreat underground during the hottest parts of the day. This is not at all surprising when one considers that when air temperatures reach 115 degrees F. at the height of a man's shoulders, the sand surface upon which Uma lives may reach 189 degrees. The lizard remains active and above the surface only so long as there are temperatures that happen also to be reasonably comfortable for man.



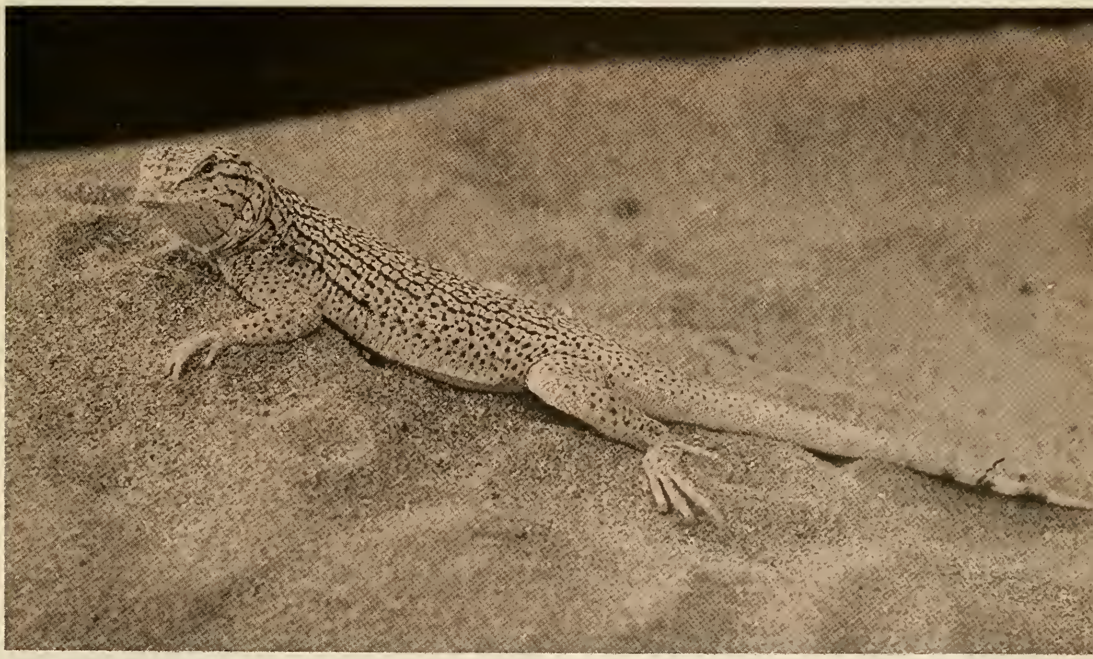
< THE FRINGE-FOOTED SAND LIZARD is harmless and most interesting to observe. If lucky you may see it run on its hind legs

∨ UMA'S "SAND SHOE" has fringes of long, flat scales. Forced outward, they increase toe surface on yielding sand



Kenneth S. Norris photos

∨ THOUGH only five inches long, Uma can run at fifteen miles an hour



Useful Plants
FROM THE DESERT

Seeds from all over the world are given a try at the Boyce Thompson Southwestern Arboretum, and the successful plants are given a short cut to fame

By JOYCE ROCKWOOD MUENCH

Photographs by JOSEF MUENCH

▲ CACTUS BLOOM. Three gorgeous red blossoms decorate this fine specimen of *Echinocereus arizonicus.* The name means "Hedgehog torch from Arizona"

▼ FRED GIBSON, President and Director of the Boyce Thompson Southwestern Arboretum, examining one of the so-called Century Plants *(Agave huachucensis).* The stalk grew the upper two feet above his hand in a few days. Century Plants spend years maturing and then die after blooming and fruiting

EVERY year quite a number of immigrants, not accounted for in their homeland quotas, enter this country. Making straight for Arizona, they try out the climate, and those that like it settle permanently somewhere in the Southwest. There's nothing secret or illegal about these newcomers. In fact, perhaps you are among some 20,000 visitors who call on them each year and admire them in their new home, the Boyce Thompson Southwestern Arboretum, near Superior, Arizona.

It's an enchanting spot in the desert, with 1700 acres of native vegetation and 30 acres of irrigated and cultivated gardens, set at the foot of Picket Post Mountain, which towers 2000 feet above. The gardens are in the Queen Creek Canyon floor and in coves beside Silver King Wash, at 2400 feet above sea level. More than 3000 varieties of plants grow there.

Graceful eucalyptus trees from Australia hobnob with the Crucifixion Plant of Palestine; Love Grasses from South Africa make no objection to being placed near Russian varieties in this botanical United Nations. Strange and beautiful plants accent the remarkable offering of our own Southwest.

Lovely as the garden is, with spring swaths of Flanders Poppies, golden mists of blossoming Chilean trees, and the cactus family outdoing the rainbow, the Arboretum is much more than just a show place.

The low stone administration building, with glasshouses projecting on either side, lathhouses, library, plant rooms, and all the rest, is the active center of a far-flung network of plant exchange. The institution, unique in its location and purpose, is the gift of a man with a great vision, William Boyce Thompson. His name is linked unforgettably with Arizona's important copper industry, most particularly at Superior, Miami, Globe, and Morenci, and he spent most of his life working with those enterprises. But he saw that the time must come when our mineral resources will be exhausted, whereas our plant resources should be replaced. Research alone would achieve this.

▲ NEAR-BY PICKET POST HOUSE was originally built by the founder of the Arboretum, William Boyce Thompson, as his winter home. It is now operated as a guest resort

He knew that of the 52 million square miles of land on the globe, almost half are semiarid. Irrigation cannot reach all of the dry areas. Nor does it need to, he reasoned, if native plants are fully utilized and shared. The great arboretums of the world, however, have been located almost without exception in the deciduous forest belts of western Europe, eastern Asia, and eastern United States, even though that kind of country represents only 12 per cent of all lands. What could be more fitting than to establish an arboretum to investigate the economic and ornamental possibilities of the "forgotten half" of the globe? And where a better spot than this natural garden at the foot of the Pinal Mountains, almost the geographical center of North America's "deserts"?

In 1929 the Boyce Thompson Southwestern Arboretum was dedicated—a privately endowed institution "to bring together, grow, and study the plants of semiarid climates with a view to determining their adaptation characteristics and economic uses." Several years before, Colonel Thompson had founded and endowed the Boyce Thompson Institute for Plant Research situated at Yonkers, N. Y.

Since that date, thousand of seeds have been brought to the Arboretum from far-off points of the compass, and others have been sent to the four corners of the globe as emissaries of goodwill. They travel without publicity, and except for the ones that grow under his watchful eye at the Arboretum, Mr. Fred Gibson, its President and Director, may never know how they fared. Hundreds of different varieties of grass seeds have been tried out, with only several proving of definite value to the Southwest. Down on the Papago Indian Reservation, the Giant Panicum Grass was introduced because it has a protein content equal to alfalfa, and it flourishes without cultivation. The Love Grasses of South Africa and Australia are being used by soil conservation authorities in this country. And Old Man Saltbush provides salt along with its nutrients on cattle ranges. But it is hard for Fred Gibson to know how many of his plant "children" are succeeding abroad.

Little has been said of the current vital research by governmental and private investigators on the lilies, the Agaves, and their relatives. Perhaps from the lily family may come the basis for synthetic

▲ In spring the golden blossoms of the Chilean tree *Gourliea chilensis* make a mist of color below the rough-hewn cliffs

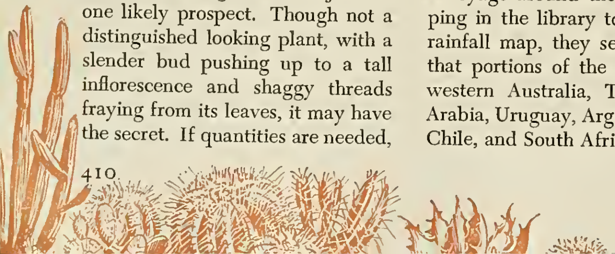
cortisone, the hope of arthritic sufferers. First obtained from animal bile through a complicated 37-step process, the cost of a few weeks' treatment was around $18,000, and there was only enough of the material for a few patients. Samples of various species of the Southwestern Agave are being collected at the Arboretum for study in chemical laboratories. *Agave toumeyana* is one likely prospect. Though not a distinguished looking plant, with a slender bud pushing up to a tall inflorescence and shaggy threads fraying from its leaves, it may have the secret. If quantities are needed, they will be raised commercially, but in these early stages, this southwestern garden is the only source of samples.

Most visitors who come only for the pleasure of seeing the desert in blossom find it a capsule of all lands having similar climates. A walk along shaded paths and into sunny alcoves of the cactus section is like a voyage around the world. Stopping in the library to examine the rainfall map, they see at a glance that portions of the Soviet Union, western Australia, Tunisia, Saudi Arabia, Uruguay, Argentina, central Chile, and South Africa have about the same quantity of rainfall. Ornamentals from the Mediterranean, pomegranates from the African coast, the weird Boojum Tree from Baja California grow beside one another. Every year the Director and his assistant, Bernard Benson, make extensive field trips to gather more varieties of cactus plants. Seeds gathered by mailmen on lonely routes in central Australia, by mining engineers in South Africa, by government workers, and by botanical gardens or students in Belgium, Holland, Mexico, or the Bahamas add to the garden's wealth.

There is a steady stream of botanists, too, many of them coming from other research centers to study. There is a guesthouse and an unusually fine library for their use, as well as the experimental gardens. Recently a professor of systematic botany from Mexico came to learn more about canaigre, or dock, the wild rhubarb. Quantities of seeds are now being picked, cleaned, sorted, and packed to send to him. He is interested in the possibility of growing it commercially, since its sweet-potato-like roots contain tannic acid. Prof. Gustavo A. Benavides hopes it may replace the failing supply of oak bark, which now supplies the tannic acid needed for the tanning of hides.

Mr. Gibson answers personally the many inquiries that come for seeds. When plants have matured and the seeds are ready, they are brought into sheds to be prepared for mailing. All sorts of shapes go through the machine or are cleaned by hand. Carefully labeled, they are then put into coin envelopes, and those not needed immediately for shipment are filed in the seed "library." Drawers reaching almost to the ceiling are filled with future trees, shrubs, cacti, and all the many other varieties of Southwestern plants. They must all be fresh seeds, and perhaps 90 per cent of them will sprout when planted.

Records are kept of various tests on the seeds — how long they keep their ability to grow, how much moisture and what temperatures they will withstand. Incoming visi-



⮝ CACTI of many sorts grow in harmony in the glasshouse of the Arboretum. Fred Gibson and his assistant Bernard Benson, on his right, are showing a visitor some of the strange plants under observation

⮞ A GIANT YUCCA IN BLOOM, *Yucca treculeana.* Its spectacular white panicles form a striking landmark against the desert blue

⮟ IN BLOOM, the paloverde tree is a cloud of gold. Countless members of the cactus family line the walks

tors join their American brothers on the shelves or in the rows of plantings in lathhouses as well as throughout the extensive grounds.

The goat nut or jojoba (pronounced ho-HO-ba) shows well how a local son may make good. It grows mainly on alluvial fans at the mouths of canyons and isn't fussy about its water supply. The Indians have been familiar with it for a long time, and an early Spanish explorer, finding it in use for treating skin cancer and as candy and coffee, termed it "California's most precious fruit." Botanically a member of the genus *Simmondsia*, it belongs to the Box family and makes a handsome ornamental hedge. But its industrial possibilities are even more outstanding. The nut contains a useful liquid wax which, when hydrogenated, is second in hardness only to the expensive carnauba. The Union Oil Company holds patents for mixing it with lubricants. Other patents cover its use in bubble gum, cloth, linoleum, baked enamel, and printer's ink. It can be used as an ingredient in ready-to-bake cakes and cookies, because it increases stability against rancidity. It can be repeatedly heated to 500 degrees without change in viscosity.

Seeds of this shrub with its leathery, gray-green foliage have been sent from Superior to Texas, Mexico, Cuba, the Bahamas, Chile, South Africa, and Australia. Commercial plantings are being tried. It requires about 10 years of growth before the nuts mature in quantities, but the plant needs little irrigation and will grow on submarginal lands where there isn't enough water for most other crops.

In a world where monetary considerations seem sometimes to crowd everything else out, the very atmosphere of the Arboretum is refreshing. You can't buy a single plant or seed, but you may have them for research or experimental purposes. Paths stretch for a 25-minute stroll along the Green Labeled Tour through Queen Creek, among lovely native and introduced shrubs and flowers, or you can take a 15-minute journey along the Yellow Tour in the Cactus Garden and Ayer Lake, actually a botanical view of half the globe.

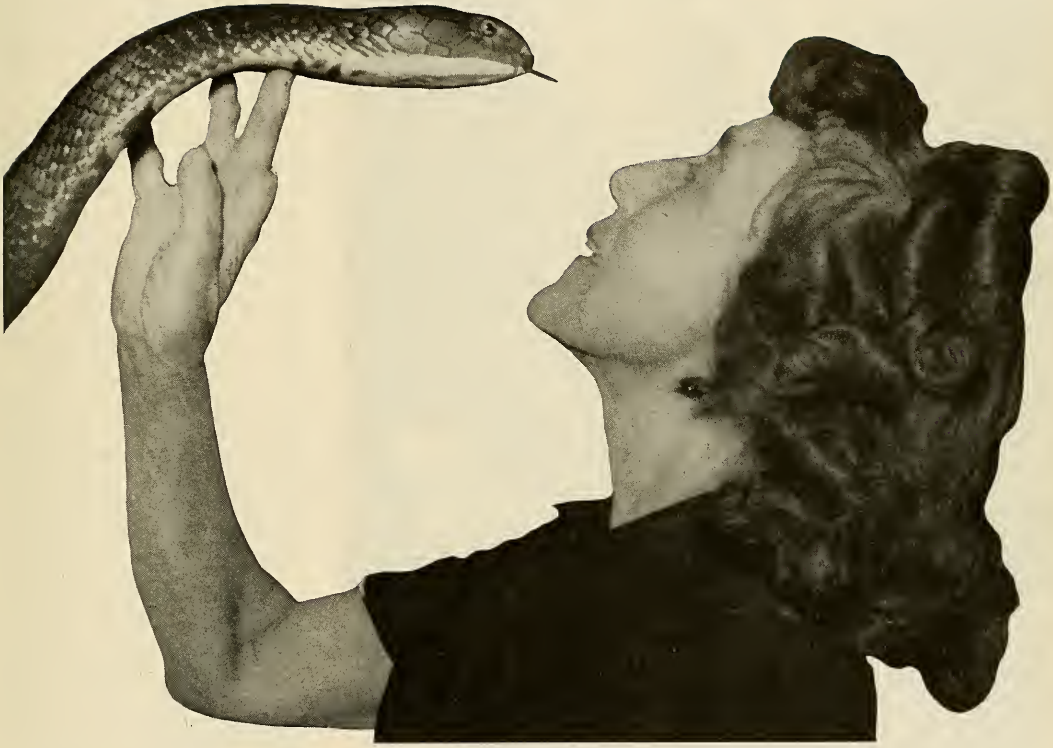
Overlooking all this is Picket Post House, built by Colonel Thompson for a home. After his death, the Arboretum sold the property, and it is operated as a guest resort, with views into the gardens and trails leading back into the mountains. Since the area is also a wildlife sanctuary, plants are not the only things to see. The variety of foliage and fruit attracts an unusual number of birds, and there are porcupines, bobcats, skunks, rabbits, and even some mountain lions, deer, and javelina.

Whether judged in terms of its functional beauty, or of the work that is going on there, the Boyce Thompson Southwestern Arboretum is realizing the vision of its founder, who said in planting a small saguaro, "Grow and bless the world."

▲ EUCALYPTUS GROVE. Far from their native Australia, the Boyce Thompson Southwestern Arboretum is cultivating these handsome trees to learn if they are adaptable to other arid environments

Grace O. Wiley was the most celebrated snake woman of our time. Were her achievements in taming venomous snakes scientifically valuable, or will posterity call her only a first-class showman?

The Lady AND THE Cobra



▲ GRACE O. WILEY demonstrating how she tamed her favorite, King, a deadly king cobra. His fangs are intact; a bite would mean sure death

By WELDON D. WOODSON

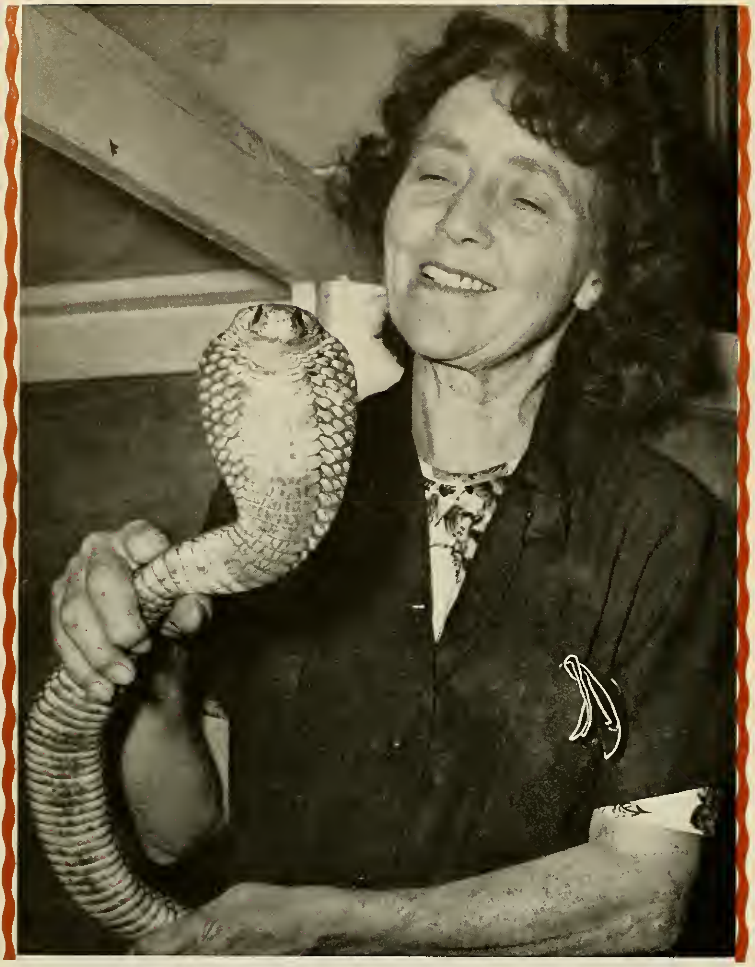
Photographs by Newton Berlin

"SNAKES are the underdogs. So many people dislike them. Yet, if handled with kindness, even the poisonous cobra will harm no one."

This is what 64-year-old Grace Olive Wiley would tell visitors to her reptile zoo at Cypress, California, 25 miles east of Los Angeles. To prove it, she frequently posed in pictures with her lethal charges.

As was her custom, on a day in July, 1948, she permitted an interviewer to photograph her with a deadly Indian cobra. This snake, however, had been acquired only lately and was not used to being handled. As she attempted to coax it to spread its hood, it drew back, then bit her on a finger. About an hour after the bite, she died in a hospital. Among her last words were instructions on how to care for and feed her animals.

Every movie-goer has seen her giant pythons and cobras on the screen. Her foremost star, King, was a fifteen-foot king cobra from the jungles of India. He and others brought chills to your spine in the



▲ **Brownie**, an Egyptian cobra, with his hood spread. Mrs. Wiley excused his nervousness on the grounds that this was the first time he had been photographed

Tarzan pictures, "Trade Wind," "The Jungle Book," and "Cobra Woman."

Remember "Moon Over Burma" and that cobra that "menaced" the blind plantation owner portrayed by Albert Basserman? These cobras were from Grace Wiley's snake farm. By "cobras," it is meant that there were two, although, quite surely, you thought you saw only one. You see, a pair of "tamed" cobras from Siam, named Illa and Indra, were on the motion-picture lot—under the care, of course, of Mrs. Wiley—and alternated before the camera. When Illa was exhausted, Indra took her place, and vice versa. They looked so much alike that when the picture was finished, no one except their trainer could tell them apart.

When my wife Freada and I made our visits to her zoo, Illa and Indra were no longer there, but King and his companion Queen were conspicuously present. Not to be overlooked was a thirteen-foot python referred to as Rocky, which I helped to handle, as well as his associate, Juniper. The skin of the latter, as is characteristic of some snakes, reflects a beautiful irridescent color. Mrs. Wiley called attention to this, then quoted from memory a passage pertaining to it from W. H. Hudson's *Green Mansions*. Various kinds of reptiles were in the barnlike structure back of her small cottage. A crocodile with the title of Mr. Ferocious, an alligator tagged Johnnie, spiny-tailed Egyptian lizards, Mojave Desert sidewinders, Egyptian vipers, a West Indian fer-de-lance, cobras from Egypt, vipers from Italy, and a krait from India—these will indicate the range of her collection.

We spent a number of sessions with her. One, I shall always remember. With me as I drove in front of the Wiley cottage were photographer Newton Berlin and my wife. We had no more than gotten out of my car when out of the house came Mrs. Wiley, her 87-year-old mother Mrs. Mary Gough (known to her many friends as Mother Mollie or Auntie Mollie), and a six-foot monitor lizard from Java, christened Slinky.

With Slinky, as he lumbered along, in the lead, we proceeded to the reptile house. When the door was opened, he bolted in and scrambled straight for the great wooden box underneath a platform of smaller cages. Before he could escape, Mrs. Wiley hauled him back so that we might look him over. To tell the truth, he seemed not the least interested in making our acquaintance. When we witnessed the last inch of his tail disappear, we knew that that was the end of our friend for a while.

After we had pretty nearly made the rounds of her glass-fronted cages, Mrs. Wiley asked in a quiet but dramatic manner, "And now, would you like to see King?" There was a sort of triumphant tone in her voice. And well it should be, for her experience with this snake—the deadly king cobra, or hamadryad—has no parallel.

Not too near, but close enough to watch her, we stood as she tenderly eased his long, graceful body out of his cage. For you who think that his fangs were pulled or that he was regularly milked of his poison, let me state that that was not the case. She did not tamper with the poisonous apparatus of any of her venomous snakes, for to do so, she pointed out, would be injurious to their health. Yet, with their fangs intact, she handled them unafraid!

In catering to King, however, she drew the line when it came to feeding him a preferred diet—other snakes. To her, a snake is immaculately clean, friendly if you meet him on his own level, and worthy of as much interest and study as a pet dog or cat. When handling one, then another, she would wash her hands—not for her own sake but to prevent the spreading of any possible contagious disease among her reptiles. She valued each one that much.

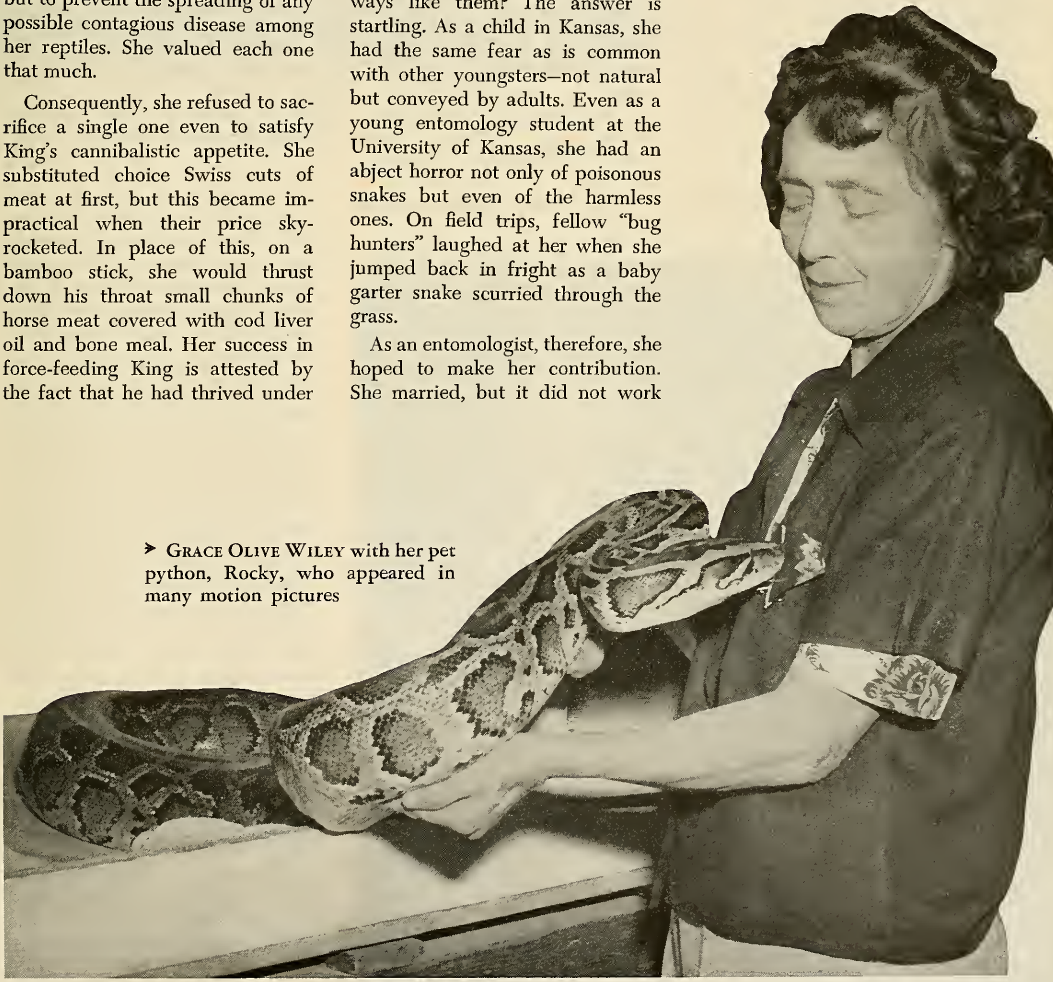
Consequently, she refused to sacrifice a single one even to satisfy King's cannibalistic appetite. She substituted choice Swiss cuts of meat at first, but this became impractical when their price skyrocketed. In place of this, on a bamboo stick, she would thrust down his throat small chunks of horse meat covered with cod liver oil and bone meal. Her success in force-feeding King is attested by the fact that he had thrived under her care, along with Queen, since August of 1934.

With the help of Mother Mollie, Mrs. Wiley worked King out of his cage. He was of such a great length, however, that with his trainer at the dangerous end, the head, and Mother Mollie holding him up in the center, a full third of him was left hanging awkwardly down onto the floor. I sensed the unshapely setup; so did Newt and Freada. For the sake of suitable pictures, I reluctantly supported the tail end as he weaved to and fro; and once he nudged his nose against my hand.

The inevitable question is how did she come to handle poisonous snakes so intrepidly? Did she always like them? The answer is startling. As a child in Kansas, she had the same fear as is common with other youngsters—not natural but conveyed by adults. Even as a young entomology student at the University of Kansas, she had an abject horror not only of poisonous snakes but even of the harmless ones. On field trips, fellow "bug hunters" laughed at her when she jumped back in fright as a baby garter snake scurried through the grass.

As an entomologist, therefore, she hoped to make her contribution. She married, but it did not work out. While still with her husband, however, she went with him to Texas, where she collected insects for the University of Kansas. Subsequently, she organized nature classes among children, wrote articles on insects, and gave talks. Her enthusiasm for entomology can readily be realized from the fact that her name is perpetuated in the names of nearly a dozen insects.

During this time, she determined to conquer fear of snakes. Soon she was able to handle the harmless ones like other naturalists. In 1923, she became Curator of the Museum of Natural History, Minneapolis



➤ GRACE OLIVE WILEY with her pet python, Rocky, who appeared in many motion pictures

Public Library. Here, she maintained a collection of live reptiles. While talking to a visitor one day, one of the rattlesnakes crawled across her hand. This instilled in her the desire to "tame" poisonous snakes.

She invented a petting stick, which consisted of a pad of cloth tied to the end of a short bamboo feeding stick. She would stroke them with this. Shortly, she could pet them with her hand.

To "tame" King and Queen upon their arrival in 1934, she employed two three-foot sticks. One had a heavy wire at the far end spread out in a U-shape. This stick was to be held in the left hand as a shield to push the snake back if it attempted to rush out or strike. The other—the petting stick—was padded at the end with a soft cloth, with which she would gently pet or touch the reptile.

▲ THE AUTHOR on the "safe" end, with 87-year-old Mother Mollie holding up the middle. This is Grace Wiley's favorite, King, and she shows no concern within inches of its fangs

▼ A CLOSE-UP OF SLINKY, the six-foot monitor lizard from Java, with his tongue out

"At first," she writes, "the kings were so excited and touchy, they snorted and blew, reared, spread, jerked, and twitched, when the padded stick touched them." They refused the various kinds of food placed in their cage. The fifth day after she started petting them, she was able to force-feed the smaller cobra, Queen, and the next day, she succeeded with King. At this time also she began to handle them. On October 23 of that year, she helped King to shed his skin, even pulling off the eyelids with small forceps. After stroking and petting him about the head and neck, she rested his head on one hand with him facing her. "He was unafraid and put out his tongue in such a knowing manner," she commented.

In reflecting over Mrs. Wiley's tragic passing, the question arises: Did she make any significant scientific contributions? Quite surely, she fell far short of her goal. She desired to make the Cypress Reptile Farm one of the largest of its kind, to which not only the public but herpetologists the world over would come. Travelers to India, she lamented to Freada and me, went there to capture or kill animals, not to make their acquaintance and study their ways. Her greatest ambition was to go to India's jungles and "tame" cobras in their natural haunts—replicas of her charge, King. She planned an autobiography that would detail her experiences and findings, but she wrote only a few paragraphs—the opening, or preamble, one might say—which she read with sincere fervency to us one night as we sat on a sofa in her cottage.

One may well wonder, however, whether her inductions were not motivated by the heart instead of the mind, with a bias for the snake and without objective observation. How intelligent are snakes? Obviously they have vision, but do they have any power — other than to detect vibrations, temperatures, or odors — with which to discern the near-by presence of a being? Can they recognize one human from another? Have they memory? These constitute some of the questions she was frequently asked.

Consider a portion of her answers, culled from her paper, "Taming King Cobras."* "Snakes are very intelligent and 'catch on' much sooner than we do to indications of sympathy—that is, they are not, as a rule, afraid to trust you first," she states. Then, there is this from her published notes on force-feeding a pair of king cobras: "I am positive that they know and recognize me." And in another place, referring to the various poisonous snakes she has "tamed" (including thirteen species of rattlesnakes, the Australian tiger snake, and the Gaboon viper), she sums up, "Somehow they know very, very soon that I am friendly, and that I like them. They appear to listen intently when I stand quietly at their open door and talk to them in a low, soothing voice. In some unknown manner my idea of sympathy is conveyed to them."

Needless to say, herpetologists have challenged the implication of these statements. There is little to be gained by saying that "snakes are very intelligent" and "catch on much sooner than we do to indications of sympathy—" or that "I am positive that they [her cobras] know and recognize me," unless some evidence is provided to substantiate such conclusions. Contrast her intuitive methods with the traditional methods of science in recording observations and comparing them with other data so as to derive a tentative conclusion. Her frequent use of "I am positive" and its equivalent in conversations is contrary to the attitude of the true scientist who, after first presenting the facts, couches his conclusions in such guarded language as "it seems," "this would indicate," "probably."

From my own limited firsthand observations of her work, I was persuaded that goodwill toward her subjects sometimes prompted unscientific judgments. As we have watched Mrs. Wiley fondle her exhibits, calling them by endearing names as one does a pet dog, we could not help but note that an action she hailed as a response to her beckoning seemed more of a coincidence. If there was no apparent reaction when addressing or caressing an animal, this was ignored or excused in one way or another.

She claimed that, although she experienced about 40 bites, none came from "tame" animals. All allegedly were from newly-acquired specimens—those which she had not put through the patient process of becoming accustomed first to the petting stick, then to her own hands. Poisonous snakes are not "vicious or mean," she contended, "but only afraid, panicky, terror-stricken, like a frightened bird or mammal at first."

Even the then freshly-obtained Indian cobra that inflicted the deadly bite became "tame" due to the attention of Wesley H. Dickinson, who when a youth was — as she liked to call him — her "protégé." He, likewise, handles with his bare hands the "tamed" poisonous creatures. It should be emphasized, however, that he is cautious and scientific in his conclusions.

Not long after Grace Wiley was fatally bitten, Freada and I drove up to the Reptile Gardens, Phoenix, Arizona, owned by our venerable friend, Charles L. Evans. After his enthusiastic greeting, and as we looked at sundry cages that contained recent additions, we asked him if he had read about the Grace Wiley case. Smiling, he pointed to a cage and said, "There's the cobra." Not only did he exhibit that one but others that we had seen at her zoo in Cypress. Like most of mankind, Evans, despite — or, more accurately, in view of — his many years of familiarity with reptiles, looks upon the venomous kinds as dangerous and handles them with tools.

One may remark, "Why wasn't the cobra killed?" Mrs. Wiley, herself, would have been the first to protest. Indeed, after it struck, she took the fangs from her finger, gently held the reptile with both hands, and returned it to its box. It was the first time it had been taken out of doors, and it became nervous. "They strike in defense only when frightened," she would often say. One must add that they may also strike when hungry. In view of the fact that she force-fed many of her snakes, however, the creatures probably never had an opportunity to strike at their prey.

From the human-interest standpoint, which the press played up, this cobra had a letter "G" on its back, whereas most cobras of this type have an "O" marking. The "G" is distinct, as I personally could see upon my visit to the zoo when Dickinson brought the snake out of its cage and showed it to me. Since Mrs. Wiley's given name is Grace, beginning with "G," I have been told that she thought of it as a good omen. Instead, so the newspapers wrote, the "G" mark was a "morbid prediction of its fatal association for her."

Over a long period of years, she tended with her bare hands some of the world's most poisonous snakes. It is not surprising that she experienced approximately 40 bites. Many will say that this alone disproves her claim. Any of these bites might have been fatal. She always said that only the "untamed" snakes ever bit her. But in view of her tendency to shut her eyes to anything unfavorable toward her captives, one may well wonder whether the very fact that a snake attacked her was not accepted as proof that it had not been "tamed." Finally, any experienced keeper knows that once a snake has become accustomed to conditions of captivity and the presence of people, it can be handled, but never without some risk.

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* Natural History Magazine, January, 1937.

It has been stated that with her "tamed" poisonous snakes, she achieved much that was beyond that of other curators of reptile zoos. She bred rattlesnakes in captivity, a feat carried to the second generation. Instances have been known where the rattler, ensconced in a dark box away from the public, has given birth to young, but hers were in their cages exposed to the passing throngs. Here, they have gone through their life cycle, apparently unhampered by this unnatural environment. When force-fed, reptiles generally don't fare too well in captivity. In contrast, her specimens tended to be exceptionally healthy and long-lived. Zookeepers must use sticks in tending venomous snakes, but her dependence upon her hands gave freedom that wrought surprising results.

In commenting on this, her success in maintaining many of her captives in a healthy condition has been duplicated by zookeepers and others willing and able to devote the time to it. As one herpetologist has summed it up, what Grace Wiley did as a snake handler, anyone could do if he were "silly enough" to take the chances that she was willing to take.

On the other side, it has been asserted that by means of the lecture platform, magazine articles, radio, newsreel, educational film, and major studio motion-picture productions, she has contributed much in popularizing "facts" about snakes. She has been credited with having inspired hundreds of young herpetologists to overcome the prejudices that have generally existed toward snakes. She was an expert in herpetological photography, and, among other features, of the life history and habits of snakes. She took the first motion picture of a rattlesnake shedding its skin.

Actually, though, it can be seriously questioned whether she helped greatly to make known to the public the *facts* about them. In the light of her intuitive methods, it can be doubted whether many of her statements can be accepted as *facts.* Once when I asked a herpetologist whether her notes would be published, he replied that he really did not know, for whoever tackled the job of editing them must exercise extreme care to separate the chaff from the wheat, for not to do so would be putting at stake one's own scientific standing.

Then, too, it is dubious whether her techniques have accomplished much as far as persuading people to overcome their prejudices. She may, indeed, have shown that snakes can be induced to part with their normal fears — scarcely a novel observation. But the fact that she was repeatedly bitten and finally succumbed from a bite (with each incident rather widely publicized) makes it difficult to state flatly that she influenced many individuals to rid themselves of their prejudices.

In defending poisonous snakes, it must be admitted that she did not imply that just anyone could — or should — handle them as she did. She wrote that they have different ways of showing their moods, but to be able to "*see* and *read* these signs," one must "*know*" these animals well. (Italics hers.) "When they are nervous or excited, no one should work with wild, poisonous, or otherwise dangerous creatures."

By coaxing an occasional aspiring herpetologist to take dangerously poisonous snakes in his unprotected hands, she ran the risk of his eventually being bitten. Publicity of that sort is apt to make the public all the more antagonistic toward snakes in general, since it tends to group them all together. Most naturalists champion only the harmless kind and, by differentiating between the nonvenomous and venomous, lessen the belief held by so many that "all" snakes are to be shunned or killed at sight.

In evaluating Mrs. Wiley's work as a herpetologist, one must call attention to two factors that seem to dominate her life—one, a sincere desire to be recognized as a scientist, the other, a passion for attention and publicity. We do not conceive of a genuine scientist as having at his elbow a press agent. Rather, we picture him in the obscurity of his laboratory patiently and painstakingly arriving at facts and conclusions from his observations and experiments. Mrs. Wiley's attempt to travel two paths simultaneously resulted at times in incongruous situations.

As an example, after serving as Curator of the Museum of Natural History, Minneapolis Public Library, she became Curator of Reptiles at the Brookfield Zoo, near Chicago. While at the latter place, a controversy occurred between her and a superior over a local newspaper story about the reptiles at the zoo. The official charged that she had not received permission for the reporter to interview her. She countered that she had. In his remonstrances, he compared the kind of publicity given the institution in this instance to the ballyhoo for a "fan dancer." One does not need the Brookfield side of the story to realize that a parting of the ways was inevitable. Pathetically, though, Mrs. Wiley felt so embittered that she preferred that I omit any mention of her ever having been at the Brookfield Zoo in depicting her career.

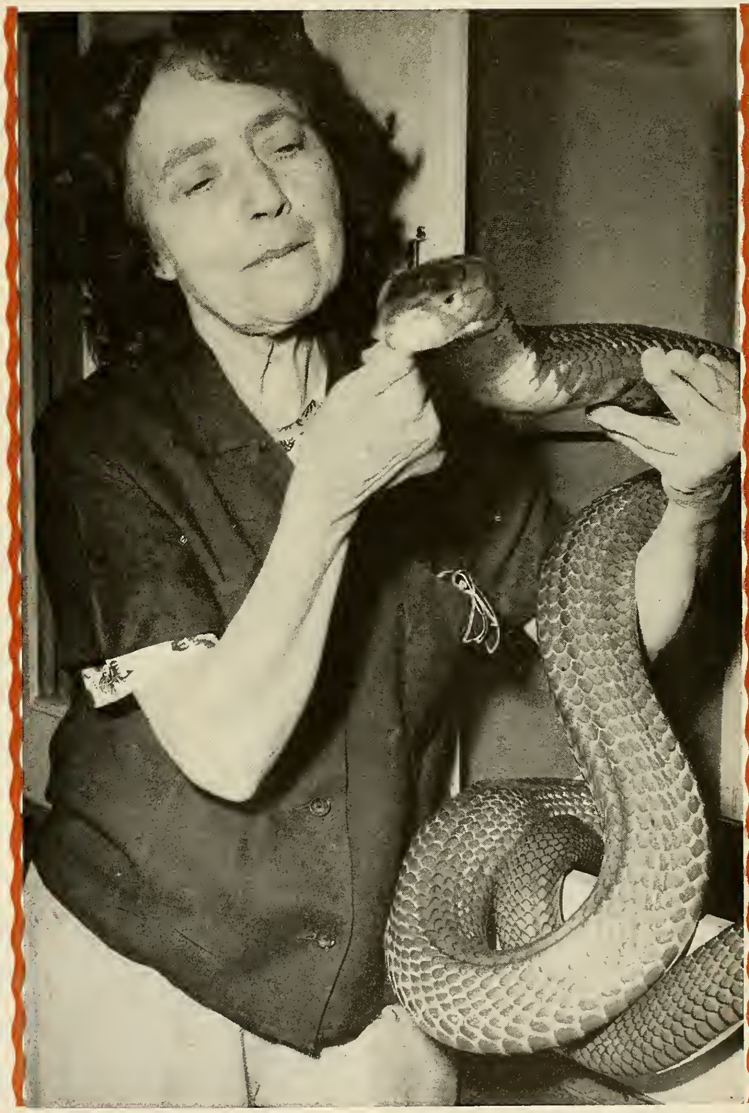
On the other hand, her yearnings to be accepted as a scientist caused her on occasion to resent the type of publicity she received. A good illustration of this took place following her severance with the Brookfield Zoo. In 1936, she came to California, where she rented her snakes to motion-picture studios. Although generally pleased with the many articles that appeared about her animals, one aroused her deep indignation. The writer, a well-known Hollywood public relations man, evidently assumed that anything to make the story exciting was permissible, for his piece gave the impression that her most poisonous snakes crawled at random throughout the building in which she housed them. Over the phone she protested to him that they all resided in tidy pens and that her project was not in the nature of a carnival but educational and scientific. He apologized but said nothing could be done about it.

In fact, it grieved her that some of our outstanding herpetologists failed to approve of what she was doing. She lamented to my wife and me that, despite her long stay in California, a certain curator of a reptile house at a zoo in this state steadfastly refused to visit her place.

In reviewing her career, other details should be made known. So zealously was she interested in the welfare of her captives that she often went without food to feed them. She once exclaimed to my wife and me that she would not hesitate to sleep in the cage with her favorite cobra, King. She was affable and invariably courteous. She believed, however, that at times others took advantage of her goodwill. To cite a case, she felt that the studios did not always pay her a just fee for the services of her animals. She was an ardent woman suffragist.

I was also informed that she was acutely nearsighted. When my wife and I visited her home, she requested that I read aloud my notes about her instead of having her look them over herself. When she read to us the beginning of her autobiography, she used a large magnifying glass. My informant revealed that she felt that she took a better picture without glasses and accordingly posed for photographers without them when she handled her venomous snakes. He believes that if she had been wearing her glasses, she would have been more aware of the actions of the last cobra she handled and would have escaped its fatal bite.

Paradoxically, it appears that history will acknowledge Mrs. Wiley not as a scientific herpetologist, as she sincerely believed she was, but as a showman — the very thing she decried. As an entertainer with reptiles, herpetologists have no quarrel with her. At the same time, they candidly point out that snake "charmers," religious snake handlers of Tennessee, and similar exhibitionists provide a fertile field for psychologists. Because of the wide publicity given her claim that she "tamed" poisonous snakes, it is imperative that a warning be given the unwary who might be so foolish as to be tempted to follow her example. With her insistence that her conclusions were scientific, it is proper that they be scrutinized under the searchlight of science. For these reasons this humble appraisal has been made.



▲ Inducing King to pose. His length was said to be 15 feet, and he had never had his fangs pulled

▲ MUCH OF THE FISHERMEN'S TIME is spent making and repairing equipment, but this work is dropped whenever a school of fish is sighted

▲ THE MEN THEN GATHER on the beach, tie coils of rope to the seine, and set it aboard a boat

Caribbean Fisherfolk make a haul

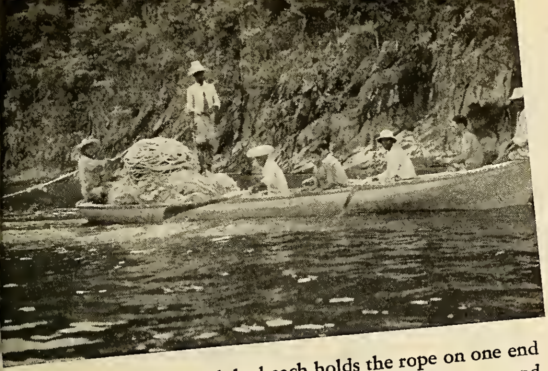
On the picturesque isle of Terre de Bas, seining is a community affair, and the aged and needy are among the first to receive a share

By KINGSLEY NOBLE
Northwestern University

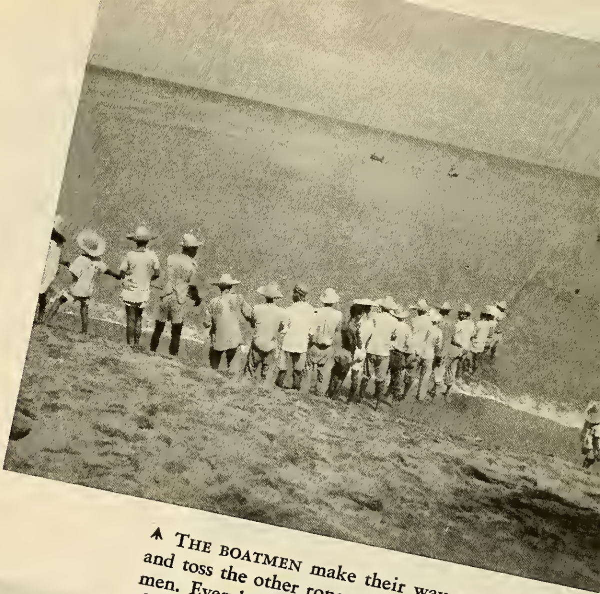
ALMOST due south of the capital of the island of Guadeloupe in the West Indies lies a cluster of islands called Les Saintes. On one of them, Terre de Haut, there is a splendid harbor and by its side a picturesque fishing village, whose facilities, including a small hotel, attract numerous visitors from Guadeloupe. Many of the inhabitants of Terre de Haut are native-born whites whose ancestors came from the maritime provinces of France. Visitors to the island have sometimes felt they were in a tropical counterpart of a French fishing village, yet the people speak a patois or French dialect, whose grammar has several characteristics found in the West African languages of the slaves.

The other large island in the cluster, Terre de Bas, is only three miles away by sail boat, but few outsiders visit it. For about ten weeks, as a student of anthropology I had the pleasure of living among the people of Petites Anses ("Little Bays" or "Little Bights"), the chief settlement on this island. Almost all of the inhabitants are colored to some degree, and they put less emphasis on personal independence than their neighbors. They are sociable and co-operative among themselves. They gather enthusiastically to watch their home team play soccer with semi-pros from Guadeloupe; and in the economic activity of seining, which is depicted in the accompanying photographs, they pool their energies and divide the catch.

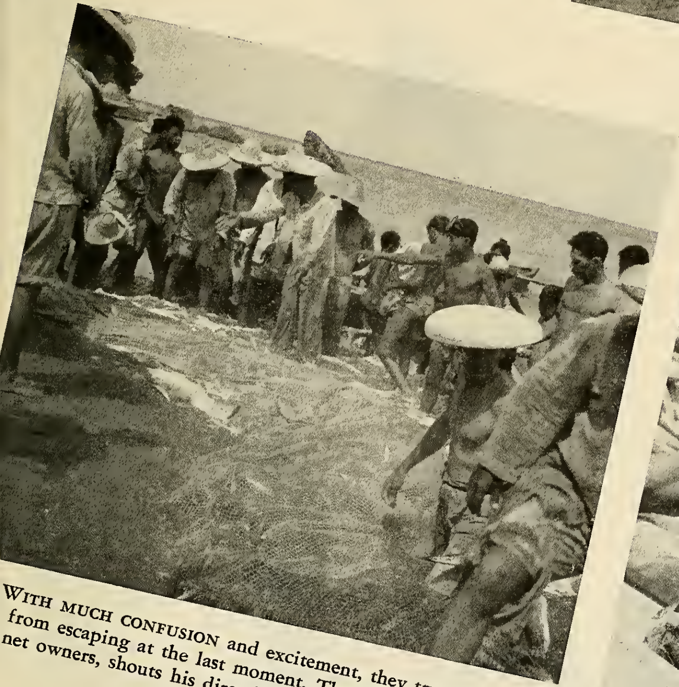
When a school of fish has been sighted in one of the bights, men, boys, and even young girls come to the beach to help with the haul. With any luck, everyone benefits. The catch is first divided so each helper receives enough fish for a meal. The aged and needy take advantage of this hand-out and hobble down to receive a share as charity. The remaining fish are sold and the proceeds divided. Half goes to the owners of the equipment, and half is split equally among the workers.



▲ A GROUP at one end of the beach holds the rope on one end of the seine while the best oarsmen row the long boat around the school of fish, paying out the net as they go



▲ THE BOATMEN make their way across the bight and toss the other rope to a second group of fishermen. Everybody then pulls the net slowly toward the shore

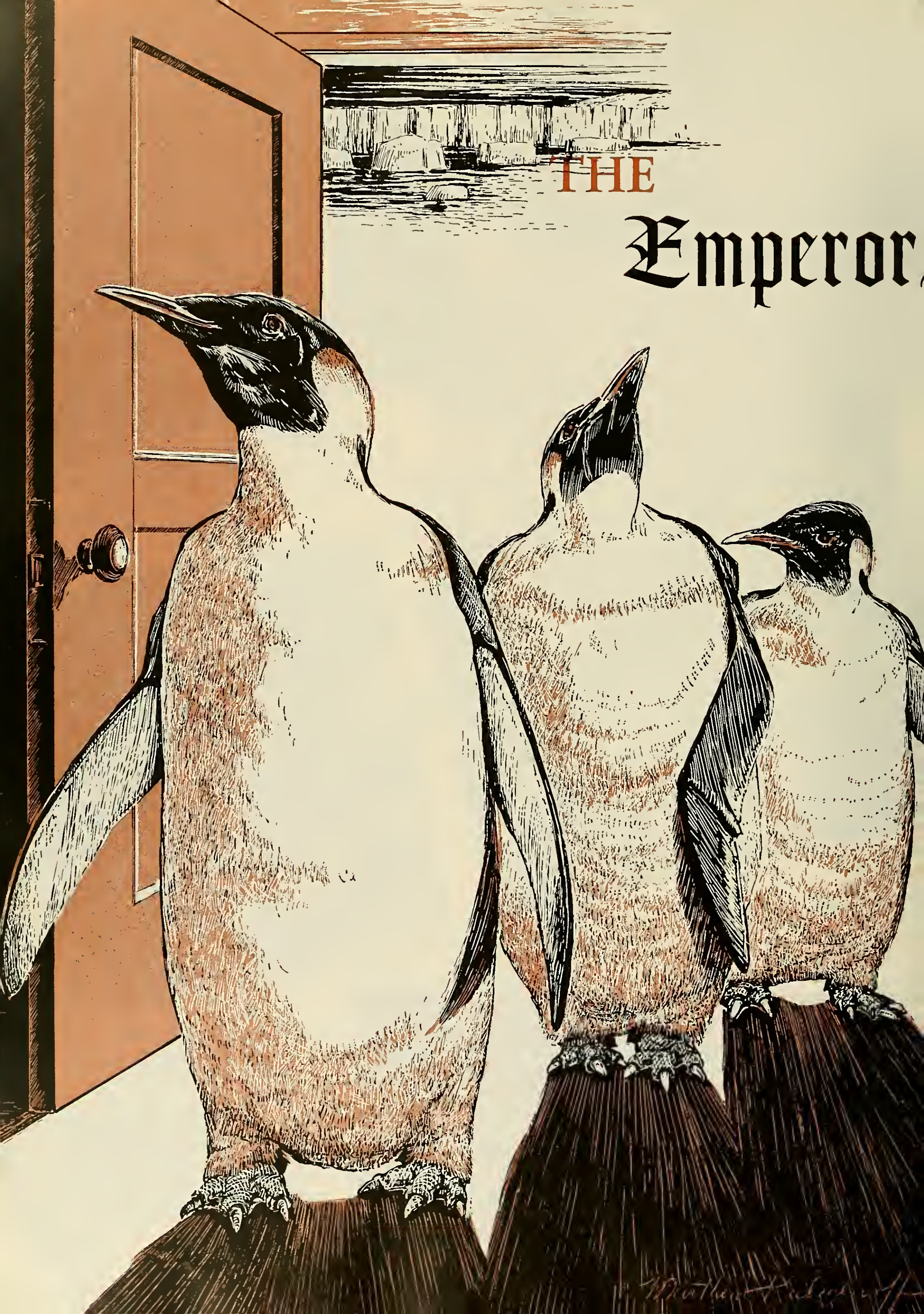


WITH MUCH CONFUSION and excitement, they try to keep the from escaping at the last moment. The leader, who is one of net owners, shouts his directions above the clamor

▲ TWO BOYS string together the fish they have received as their preliminary share of the catch

◀ THE REMAINDER of the catch is loaded into an open boat and sailed to market. Before the fishermen can return home, they must pull the boats high on the beach and lay the nets out to dry

THE Emperor



Like the man in the well-known play, they stayed a year. They shed their "frock coats" and endeared themselves to their host—the only person who has ever entertained the world's largest penguins for so long

WHO CAME TO DINNER

By H. W. Reynolds

As told to N. Pelham Wright

Drawing by Matthew Kalmenoff

I live on the coast of Tierra del Fuego, near the southern end of South America. Specialists often travel to distant places to study strange animals, but I have had one of the world's strangest creatures swim nearly 1000 miles from where it was born to land on my doorstep. The animal was the Emperor Penguin, one of the least-known and most interesting birds—and one of the largest. No less than three of these magnificent creatures have arrived from the Antarctic as uninvited guests on our seaside farm. One of them was more than four feet tall.

So far as I can find out, no one else has been able to study this curious, flightless bird for any length of time in captivity or as a pet. I made myself personally responsible for looking after two of our visitors. We accepted them as frock-coated ambassadors from another world and learned to love them—but that is getting ahead of the story.

This largest of the penguins normally breeds only on the ice surrounding the Antarctic Continent and rarely travels farther north than the West Antarctic Archipelago. I know of only five Emperor Penguins that have been encountered away from Antarctica—four on the shores of Tierra del Fuego and one on Kerguelen Island, in the South Indian Ocean, about 1200 miles away from Antarctica.

After their long swim, our birds seemed very tired. They moved about very little to begin with, as though recovering from an ordeal. I believe that abnormal weather conditions may have been responsible for their journey. They came in early winter (May or June), after a period of storms. They doubtless crossed much of the distance on northbound ice floes, but these floes would have broken up far from our shores and the birds must have had a very long swim.

The Emperor is easily the largest kind of penguin. Ours were imposing birds; one of them, as I say, measured over four feet in height when standing quite upright with the neck extended. The heaviest one weighed almost 62 pounds.* They were all young birds, for they obtained their first adult plumage while they were with us, and we could never know whether they were fully grown or not. Both of the birds I looked after lived with us for a whole year, so I had plenty of time to get to know them well. Both were extraordinarily tame, though they would not allow anyone except my mother and me to do absolutely as we wished with them.

What seemed to be most extraordinary for a swimming bird was that these penguins evidently had a dread of the sea, possibly the result of their long voyage. Once or twice we took the first bird down to the beach in a wheelbarrow to see whether he wanted a bath or would swim, but he always fled from the water as fast as he could, as though frightened of it. It has been suggested that he may have been afraid of sea leopards—spotted Antarctic seals. We therefore gave up all attempts to give the penguin a sea bath and instead built a small cement swimming pool for it in the garden. When this was filled with fresh water, he thoroughly enjoyed it, but he would never enter it if he knew he was being watched.

One of the most remarkable things about the Emperor is that both the male and female have a fold of skin between the legs in which the egg is carried about. Without this, no Emperor chicks could hatch, because the egg is incubated entirely on the ice, and it would freeze shortly if it were left in contact with it. When mature, the Emperor has a yellow patch on the side of the head, which reminds you of the coloring of the much smaller King Penguin. But in other particulars the two are very different.

Another thing that surprised us was that none of these birds would touch fish. Squids probably form a large part of the bird's normal diet. We fed them on raw meat, necessarily by hand. These birds apparently cannot eat from the ground, and we had to put each piece of meat into their beaks. If we ever put in a piece of fish instead, the bird would reject it vigorously, showing every sign of intense annoyance.

The first bird landed on a near-by

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* One Emperor Penguin is known to have weighed 94 pounds, and the average is around 70 pounds.—ED.

beach and was brought to us in a car. It spent most of its time in the chicken-run, but I would quite often take it out for walks. It seemed to enjoy this and followed me slowly, rolling along like a seaman. (Penguins on the ice are known to drop to their breast and toboggan rapidly along, using their powerful legs and wings at nine or ten miles an hour.) The second bird had the complete freedom of our large front garden —and, incidentally, never trod on the plants! This one learned very quickly to open even difficult gates by watching how we did it. It used to let itself out and go for a walk alone when it wanted to, returning always in a very dignified manner when it wanted something to eat.

Proof that it learned to open gates from our example is furnished by the fact that, when it wanted to come into the house for company, it once or twice succeeded in turning the heavy round knob on the front door with its beak. Unless it had watched and understood our actions on entering the house, the bird could hardly have known that this was the way to open the door. I stress this because it seems that ornithologists are divided in their opinions as to whether the Emperor possesses much mental capacity. I think this gate- and door-opening business proves that the bird can observe an operation quite foreign to its normal life and, with only a beak in place of a hand, imitate the action to attain a desired objective.

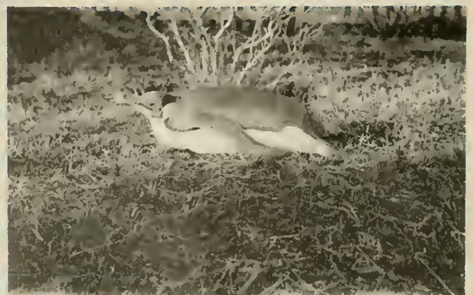
On the other hand, Emperor Penguins sometimes behave in such a manner that one might suppose them governed only by blind instinct or unreasoning emotion. Dr. Robert Cushman Murphy points out that during the brooding season the desire to mother something is so strong that eggs formerly frozen and long addled, as well as dead chicks and lumps of ice, are tucked onto the feet and covered with the feathery muffs of would-be fathers and mothers. "So avid and blind, indeed, is the interest of parents and foster parents alike in eggs and chicks that the resulting struggles work entirely gratuitous hardship upon the offspring, many of which are literally killed by kindness. No sooner does a brooding bird indicate its readiness to give up its charge than a scrimmage takes place, with dozens of free adults competing savagely for the honor of the next turn. As a result, the young are very roughly handled, their skin is frequently torn, and sometimes they become lost altogether by dropping into a crevice, in which they freeze to death while the old birds are completing a pointless argument above them." Even this dismal scene does not convince me that Emperor Penguins are not capable of learning from observation, and I might point out that parental quarrels of a similar nature are observed even in the highly intellectual human family.

The birds would always "answer me" when spoken to, and we used to carry on spirited conversations from opposite ends of the garden. In the end, they would always come to me. As far as I could make out, they made three distinct noises, each with a special significance. When they were pleased with themselves, they would utter one of these sounds. A second call seemed to denote surprise or astonishment. And the third was a sign of annoyance or anger. I learned to imitate these three noises reasonably accurately.

After about six months, the birds underwent a complete molt. In this, they shed not only the feathers but also the skin, including that of the legs and feet and the sheath of the beak. The plumage that came afterward was resplendent and quite obviously their first adult attire, which proved to us that they were all young birds. The annual molt is evidently a major problem for the Emperor. The birds fasted for an entire month. During this time they stood erect on almost the same spot and lost a lot of weight. To my certain knowledge, one of them did

Continued on page 430

THE AMBASSADORS from Antarctica molted and became resplendent. In the posture shown below, Emperor Penguins make nine or ten miles an hour on ice



◄ Ephraim Taylor, putting the finishing touches on a modern replica of one of the pipes that have made the region famous. He is applying heated beeswax with a cloth to give the pipe a lustrous sheen, which it will retain indefinitely

The REDMAN'S *Garden of Eden*

A National Monument dedicated to peace commemorates the spot where the Indians secured the red pipestone for their ceremonial pipes—a region rich in historic lore

By Arthur L. Center

All photographs by the author

From atop the quartzite ledge, we overlooked a panoramic view of Pipestone National Monument, with its blood-colored crags, small glacial lakes, virgin prairie, and small wooded area. The place: southwestern Minnesota; the time: 1950. Yet the present faded under the weight of legends that bind this region to another era and another culture. For this was the scene of the Sioux Indians' version of the creation of man. This was the birthplace of the American ceremonial pipes—and the only Monument in the United States dedicated entirely to peace.

Mr. Lyle Linch, Superintendent of Pipestone National Monument, directed our gaze over the wind polished ledge to what looked like two large fossilized bird talons in the rock. We were gazing at the footprints of the Great Spirit of the North American Indian. Here, according to Indian lore, the mighty God stood in the form of a huge crow and molded the Redman from a piece of pipestone. The Indians, Mr. Linch informed us, believed the rock got its streaky red coloring from the trickling blood of slain bison, which the Great Spirit devoured for nourishment.

So this region was doubly sacred to the primitive Indians. It was the place of their origin and the only locality they knew of where the peculiar red stone could be found. According to ancient legend, a Yankton squaw accidentally discovered the red pipestone while pursuing a white bison along the banks of Pipestone Creek. When the bison scraped the topsoil with its hoof, she saw the indurated red clay. From this soft clay stone came the ceremonial pipes. The pipes were originally used in a variety of rites, including those for war. But in more recent times they have been idealized as a symbol of peace.

Quarrying the pipestone was a very solemn ritual to the Indians. The Great Spirit, legend claims, assembled the Indians to announce that the rock itself was their congealed blood. Before the Indians would dare touch the stone, they spent days in ceremonial dances and prayers at the quarry. Then, if the medicine man said the signs from the sky were favorable, the braves would remove the overlying soil and quarry the pipestone, while their women and children looked on in reverence. After enough of the pipestone slabs had been broken off and laid out in the sun to dry, the diggings were covered over with the removed topsoil. This was done to "stop the bleeding" and "heal the wound." During the winter months the stones were divided among the tribal families, and pipes were carved.

Before visiting this hallowed region, it became a custom for all Indians to bury their war hatchets and observe absolute peace, for they revered this land so strongly that all men were immune from attack while here. Even the lives of paleface trespassers were spared as long as they remained around the quarries, although they were never permitted to observe the operation of removing the sacred rock. History, it is interesting to note, does not record any bloody battles in this region between Indian tribes or with the United States Army — no massacre of white settlers or the burning of wagon trains on the Coteau des Prairies. The closest massacre occurred over 30 miles away, at Lake Shetek in 1862.

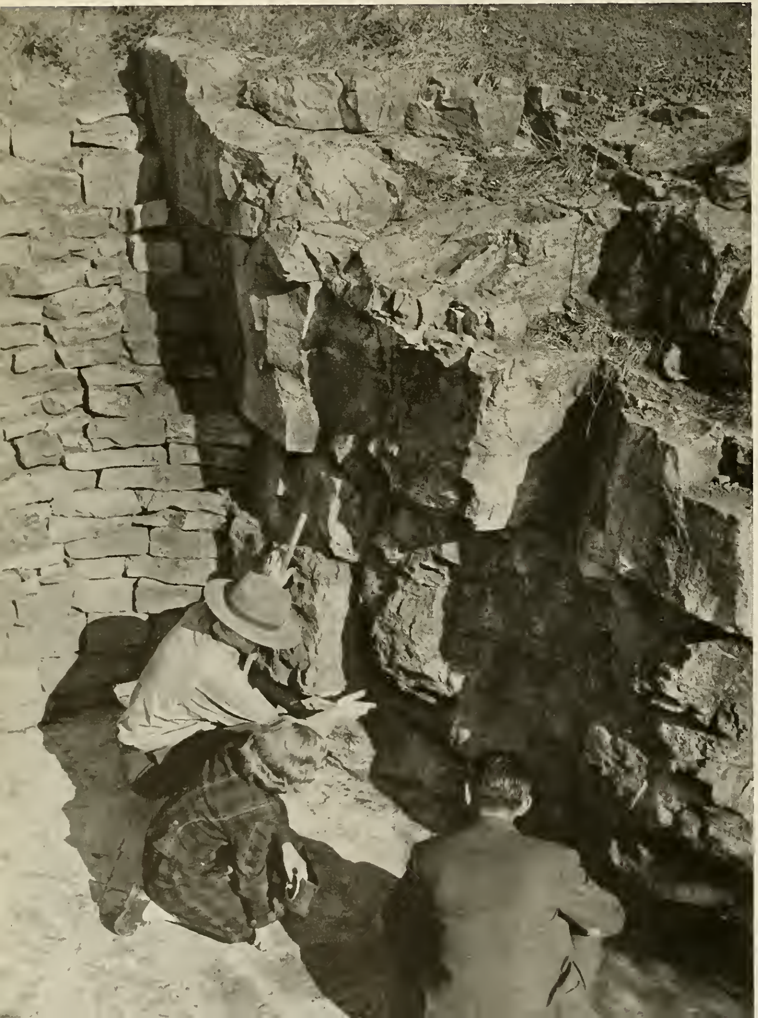
At the northern end of the area, Mr. Linch pointed out a stone monument erected near the graves of a Yankton, an Omaha, and a Chippewa who tradition says were buried side by side. "These blood enemies," he said, "now resting together in lasting peace, symbolize the eternal truce for which this place stands, so we call this our peace monument."

It was this strict observance of peace that prompted the local townspeople to call the place the Pipestone Indian Shrine long before it was officially named the Pipestone National Monument. There are still many citizens in Pipestone who would like to see the Government reinstate the former name, which they believe is more fitting.

Long before the white explorers and adventurers wrote about the Indian ceremonies, the Redman kept his own records. Several huge quartzite slabs have been found with numerous petroglyphs, etched perhaps with a piece of flint or some blunt instrument, in patterns that suggest a legend or event. Recognizable pictures of animals that frequented the plains are found beside human forms and sacred symbols of worship. Some of the best preserved of these petroglyphs were removed a few years ago to the basement of the Pipestone Public Library for safe-keeping. Here the public may inspect them on request.

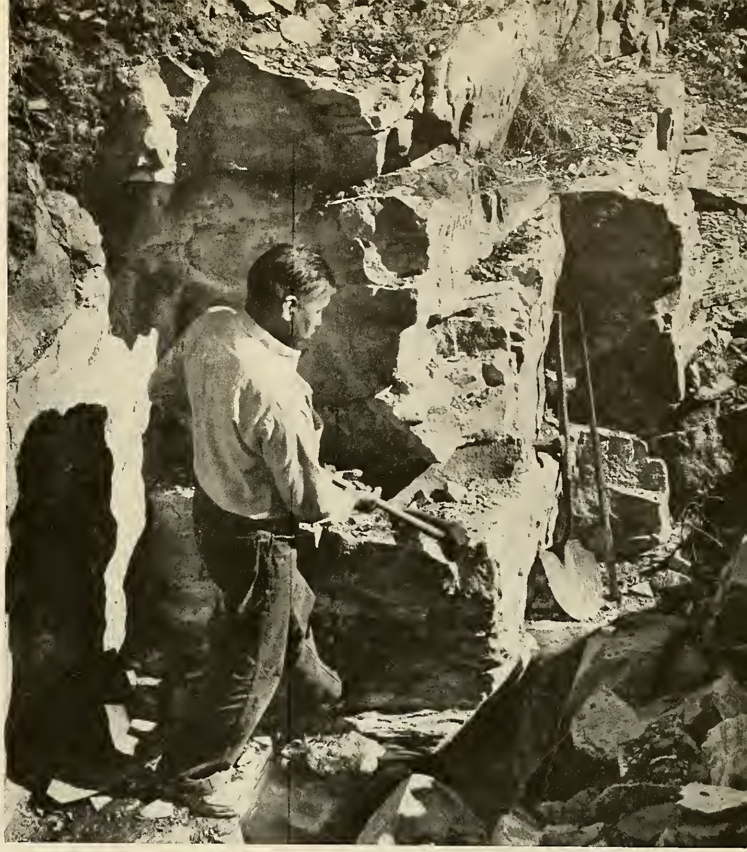
The white man's first adequately recorded visit to this spot was mentioned in the books of the artist George Catlin. Accompanied by an Englishman named Wood, he saw the quarries in 1836. Although others had visited the sacred grounds years before his arrival, the stone was named "catlinite" in honor of the first man to relate his findings in a book. Mr. Catlin also published several fascinating classic legends, which are still told today by the local Indians.

Two years after Catlin's visit, the region was entered by six explorers

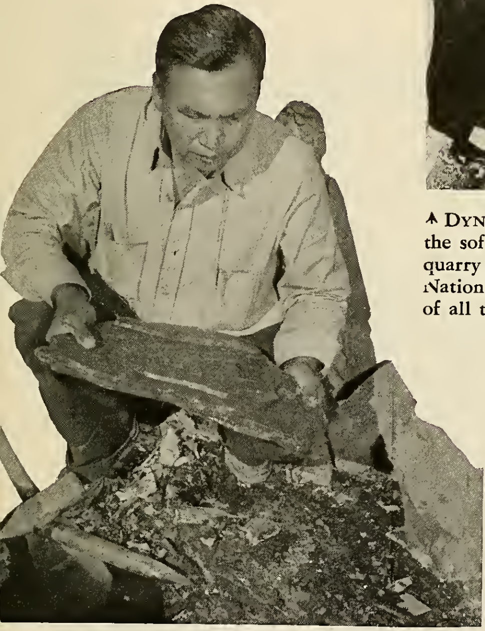


◂ THE WORLD'S ONLY EXHIBIT of pipestone in its natural position. Lyle Linch, Superintendent of Pipestone National Monument, is showing visitors how the pipestone, or catlinite, is found in layers between massive layers of quartzite led by Joseph Nicollet, who had been hired by the Secretary of War to make a geographic and geologic report of the upper Mississippi and Missouri Basins. Like the aborigines, these men left a record of their visit in stone by carving their names on a flat crag near the waterfall. Today a plaque has been placed next to the signatures commemorating this event, and the historic quartzite rock is protected by an iron railing.

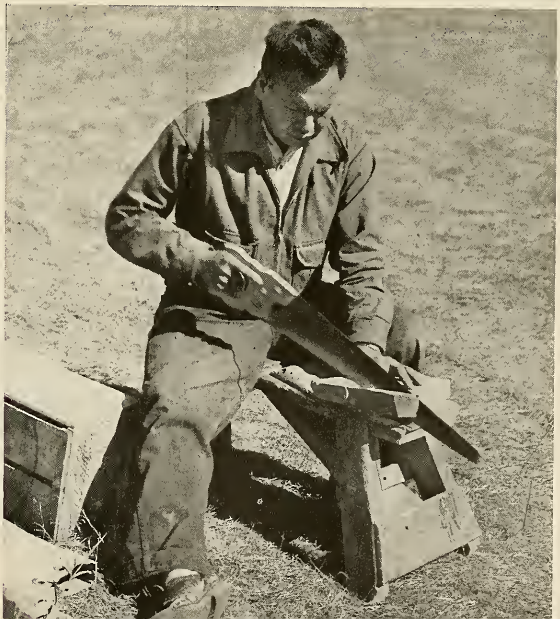
There were others who toured the area when westward expansion tamed and popularized this wilderness. Artists, authors, and poets immortalized the factual and legendary history of the land of the pipestone quarries. No doubt the most



▲ **DYNAMITE** would shatter the pipestone, so Ephraim Taylor must remove the soft, velvety stone with a sledge hammer and chisel. He operates the quarry under a Special Use Permit as provided by the Act establishing the National Monument. Quarrying of the red pipestone is reserved to Indians of all tribes under regulations prescribed by the Secretary of the Interior



▲ **A NICE THICK SLAB** of pipestone to be carved into a peace pipe



➤ **THE FIRST STEP** in making a pipe the modern way is to cut an appropriately shaped piece of pipestone with an ordinary wood saw famous and best-remembered piece of work in honor of this place is in *The Song of Hiawatha* by Henry Wadsworth Longfellow. Remember the opening lines of the "Peace Pipe Poem"?

On the Mountains of the Prairie,
On the great Red Pipestone Quarry,
Gitchie Manito*, the mighty,
He the Master of Life, descending
On the red crags of the quarry,
Stood erect and called the nations,
Called the tribes of men together.

Scarcely a spot of equal size in the United States can boast of more legendary history than Pipestone. According to Mr. Linch, there are at least 30 legends, half of which have never found their way into print. The other half remain with the Indians who still inhabit the region in great numbers. Outsiders, to hear these tales, must first obtain the friendship and trust of these Indians.

Mr. Linch is one outsider who seems to have gained some of this confidence, and the stories he narrates on his conducted tours create an aura of mysterious enchantment, missed by those who take the well-marked trail alone and uninformed. There is the story of the jealous maiden whose tears created Winnewissa Falls. And there's the story of Leaping Rock, where young warriors performed daring feats of broad jumping. Here they attempted to span the eleven feet from a quartzite ledge to the top of the narrow, highly polished Leaping Rock — a dominant geological feature in the Monument area. To the successful man there was honor and respect from the tribal warriors; to one who failed there was death, or a body mangled by a 22-foot fall on the hard rock below.

From the claw prints of the Great Spirit, where one tour makes its first stop, you walk past the natural stone face of the "Oracle," or "Chief Head," and cross the bridge to the top of Winnewissa Falls. After a study of Leaping Rock, you pause to read the Nicollet signatures near by. From here the trail leads through a field of beautiful wild flowers across Lake Hiawatha to the only *in situ* exhibit of pipestone in the world.

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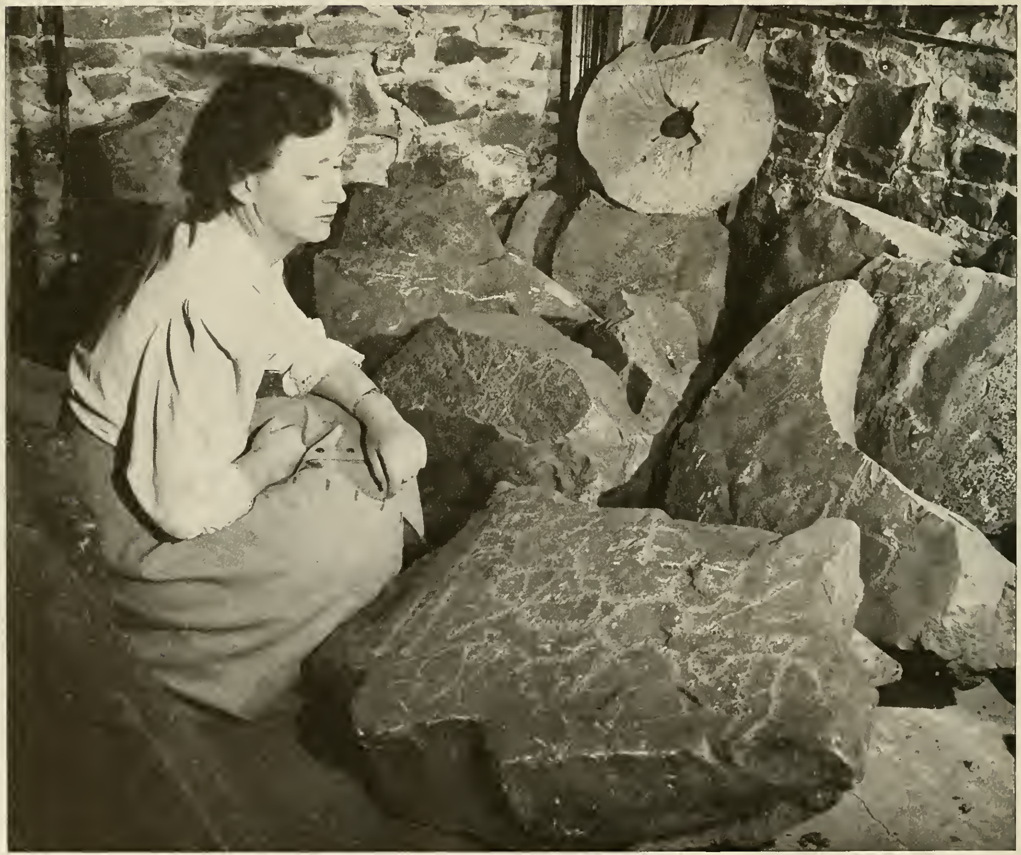
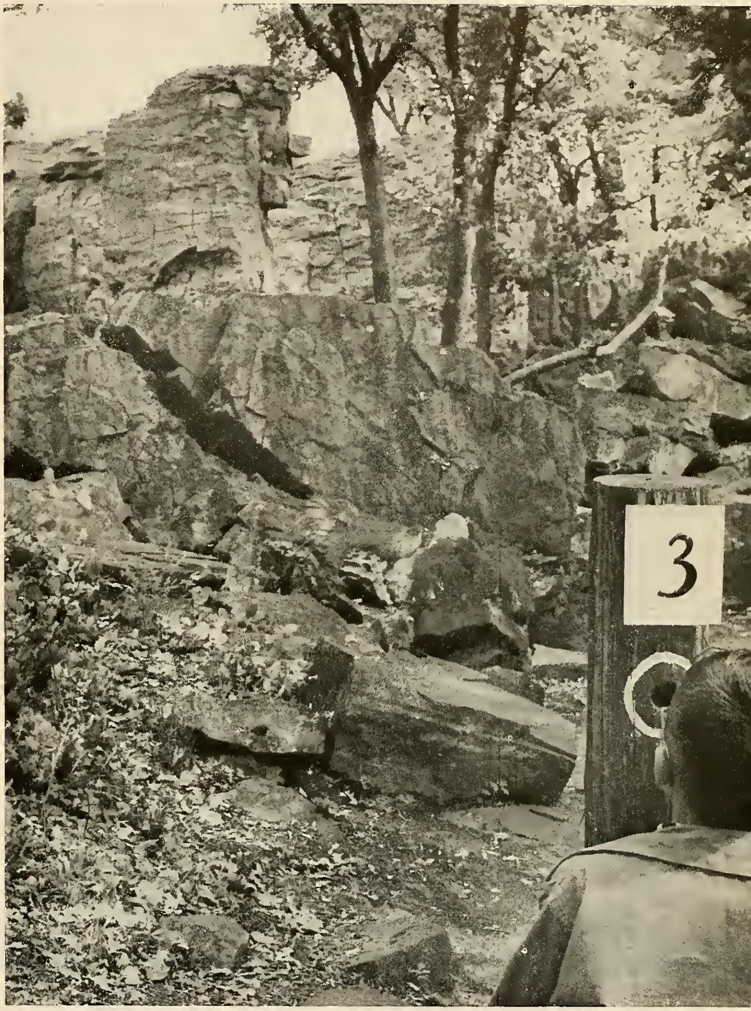
* Longfellow erred in placing this deity in the theology of these particular Indians, but the idea is consistent with their spiritual philosophy.—ED.

▼ INDIAN PETROGLYPHS from the pipestone quarries are exhibited to visitors by Miss Marycay Earhart in the basement of the Pipestone Library. They have been placed here for protection against vandalism



▼ A GREAT STONE FACE is easily seen on Leaping Rock through a hole in a post placed for the convenience of visitors along the numbered trail



Beneath the legends accounting for these strange things, there exists, of course, a scientific explanation. The pipestone, for example, is colored by a varying per cent of iron oxide instead of by the congealed blood of a bison. And the huge boulders at the south end of the Monument near the entrance gate were carried there during the great Ice Age; only in legend are they the spirits of three Indian maidens who sought refuge there during a violent electric storm. On close inspection of the lower south side of these rocks, one can see a fine example of glacial stria, or grooves, caused when boulders embedded in the ice scraped over a quartzite slab.

When the tour is over, you can watch the Indians fashioning trinkets out of pipestone. A "Special Use Permit" allows only the Redman to work the quarries and fashion the stone into trinkets. Today, two Indians quarry the stone, each operating his own mine; and unlike their forefathers, they do not stand on ceremony. The pipestone is now 10 to 15 feet below the surface. As the use of dynamite would shatter it, these two men, each operating his own mine, remove the soft, velvety stone with a sledge hammer and chisel. It is a slow and tedious job uncovering the valuable layer, so the quarries are no longer covered over after the pipestone is broken off.

A visit to the Monument is scarcely complete until one has stopped in Mrs. Roe's Trading Post in Pipestone and looked over her Indian relics. This large collection contains many pipestone calumets, as the ceremonial pipes are called, that were smoked in historic war councils, peace talks, and land exchanges between the prairie Indians and the white man.

Most of the pipes, which took Mrs. Roe and her late husband almost half a century to accumulate, were removed from Indian burial mounds or uncovered by local farmers during spring plowings. A few of them were presented to her by neighboring Indian friends, who as children witnessed quarrying operations.

Her pipe collection, like the pipestone quarries, the peace shrine, and the claw prints, contributes its share to the rich lore of the region. And all of the things bring the visitor closer to a primitive world where treaties and ceremonies were conducted under the stars, and the untamed prairie was the Redman's happy hunting grounds.

BOOKS

Continued from page 391

his book is filled with material of interest to the naturalist with scientific leanings. The student of nature who is seeking simply a source of identification will find this book the best that has ever appeared, and he may find his interest drawn to the exciting problems of butterfly biology, which lie beyond the philatelist-like approach to butterfly collecting. The elaborative chapters, on such subjects as "Some Principles of Classification" and "The Butterfly and its Environment," are well segregated, so that the reader may take or leave as much as he pleases.

For each species the *distinguishing* characteristics are discussed fully, often by means of keys. The preferred environment, habits, and flight periods are usually mentioned. Considerable space is devoted to larvae and food plants, but much of it is wasted, since the larval descriptions are frequently old and unchecked and almost none are comparative.

NATURE BOOK SALE

1. **MAN-EATERS OF KUMAON** by Jim Corbett. Tiger and jungle lore of India. "Most beguiling book about big-game hunting ever written."—NY Herald Trib. Ill. 235pp. Orig. $2. $1.00.
2. **OUR PLUNDERED PLANET** by Fairfield Osborn. Scientific study of soil erosion, misuse of lands, depletion of natural resources, etc. Discusses question: Can wealth of planet support increasing population? Orig. $2.50. 241pp. 20 copies left. $1.25.
3. **WHAT IS LIFE?** by J. B. S. Haldane. Famous biologist tells how heart, nerves, sex glands, blood, etc. function, according to new research. Orig. $3. 251 pp. $1.25.
4. **ANIMAL IQ:** Human Side of Animals by V. Packard. Differences in animal intelligence in dog, cat, elephant birds, etc. 46 superb animal and bird photos. 192pp. Orig. $2.50. $1.25.
5. **HOUSEHOLD PETS** by J. Baird. Care, feeding, training, etc., of dogs, cats, birds, fishes, rabbits and other pets. 185 ill. 302pp. Orig. $2.50. $1.25.
6. **HOW TO STUDY BIRDS** by S. Smith. New angles of approach for amateur bird-watcher. Tells how birds learn to fly, sing, migrate, etc. 192pp. 21 ill. $1.25.
7. **NATURALIST IN CUBA** by T. Barbour. Exploring caves, coves and streams; collecting reptiles, bats, mammals; note-taking on birds, snakes, lizards, and turtles. 28 photos. 327pp. Orig. $3.50. $1.25.
8. **NATURALIST'S SCRAPBOOK** by T. Barbour. Late Harvard Museum director's reminiscences about the two Agassiz', Fabre and other great naturalists. Field trip anecdotes. Orig. $3. 228pp. Ill. $1.25.
9. **INSECTS.** 225 species in full color. Complete field data. 157pp. (4 x 6). $1.00.
10. **BOOK OF FISHES** by S. Kip Farrington. 88 full-color paintings by Lynn Bogue Hunt with explanatory text. 88pp. $1.00.
11. **BIRDS OF AMERICA.** Gigantic three-vol.-in-one 832-page encyclopedia. Over 1000 pictures, incl. 514 in color. 108 color photos of bird's eggs. Easy identification charts. Full field data. Large 8 x 11 double-col. format. Weighs 6 lbs! $4.95.
12. **BIRDS** by Zim & Gabrielson. 112 birds in full color. Full field data. (4 x 6). $1.00.
13. **LIFE HISTORIES OF N. AMERICAN GULLS & TERNS** by A. C. Bent. Over 100 species. Cost up to $20 in out-of-print market. New re-issue. $2.49.
14. **RESTLESS UNIVERSE** by Max Born. Modern physics (electrons, relativity theory, quantum mechanics, etc.) explained for laymen by master scientist. Almost 1000 ill. 352pp. $3.95.
15. **BIRD PHOTOGRAPHY** by G. K. Yeates "A mine of practical information . . . an excellent handbook."—Sphere. How to construct hides. How to get good composition. 48 superb bird photos carefully analyzed to show you how you can obtain pictures of similar good quality. 9 diagrams 120pp. Big value at only $1.98

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Nearly every species has been illustrated by photographs or by colored paintings. The illustrations are of uneven quality, some being excellent but several poor. Nevertheless, the present plates will suffice for making identifications.

Some nature study enthusiasts will welcome Dr. Klots's use of "common" names for a large proportion of butterflies. Personally, I deplore the practice of concocting common names for rare or obscure species and believe that any collector experienced enough to deal with such species can also use scientific names.

These are relatively minor errors and matters of judgment. There can be no doubt that this is the best book on North American butterflies in the present century.

C. L. Remington

OTHER NEW BOOKS

PARASITIC ANIMALS—by Geoffrey Lapage, Cambridge Univ. Press, $4.00, 351 pp., 113 figs. — A book describing how parasitic animals live. Written for the general reader as well as for students and teachers directly concerned with parasitology. Dr. Lapage is a lecturer in animal pathology at the University of Cambridge in England.

DICTIONARY OF THE ARTS—by Martin L. Wolf, Philosophical Library, $10.00, 797 pp. — Definitions of words in the fields of painting, sculpture, music, theatre, the dance, literature, architecture, archaeology, mythology, ceramics, costume, and applied arts.

THE MOLDS AND MAN—by Clyde M. Christensen, Univ. of Minnesota Press, $4.00, 244 pp., 7 figs. — Basic facts about fungi—how they live, reproduce, and affect other plants and animals, including man. Readable and authoritative. Dr. Christensen is a mycologist in the Dept. of Plant Pathology at the Univ. of Minnesota.

THE DUSKY-FOOTED WOOD RAT—by Jean M. Linsdale and Lloyd P. Tevis, Jr., Univ. of Calif. Press, $7.50, 664 pp., 384 figs. — An intensive, sociological account of the wood rat, based on the histories of 580 individuals at the Hastings Natural History Reservation.

THE ALPHABET—by David Diringer, Philosophical Library, $12.00, 607 pp., 256 figs.—The second and revised edition of a compendious work dealing with the history of the development of non-alphabetic scripts and the origins and developments of alphabets, oriental as well as occidental.

BRITISH SCIENTISTS—by E. J. Holmyard, Philosophical Library, $2.75, 88 pp., 24 illusts.—Brief sketches of British scientists from Roger Bacon to William Ramsay. Account of British scientific societies. By the editor of the quarterly journal of science *Endeavour*. Nontechnical.

THE EMPERORS WHO CAME TO DINNER

Continued from page 424

not move outside an area of two square yards. They were obviously very uncomfortable during their molt. When the new coat, which had formed underneath the old skin, began pushing the latter outward and breaking it up, the birds would help the process by pushing the old skin away with their beaks. My mother used to help them, and they obviously liked to have her do this. But if we tried to take off a piece that wasn't ready, it evidently hurt them and they would gently peck us for our pains and treat us to the "annoyance noise." When they apparently felt that their transformation was complete, they let themselves go and, repeatedly uttering their "pleasure sound," left their two square yards of "isolation ward" and came up to the house to break their month's fast.

I became so much attached to these birds—and I really believe they felt some sort of affection for me—that when they eventually died (in each case of a parasitic ailment), I felt a very deep sense of loss. As you can imagine, I often look rather wistfully along the beaches in the early winter, hoping that we may have yet another portly black-and-white visitor from Antarctica. The affection one can feel for a favorite dog was in this case enhanced, in a sense, by the fact that these creatures had come from another world, where men were unknown to them and where there had been no background of domestication. I often wonder what effect a few generations of domestication would have on the Emperor Penguin and what height of attachment or intelligence the bird could attain through continuous and intimate association with man.

LETTERS

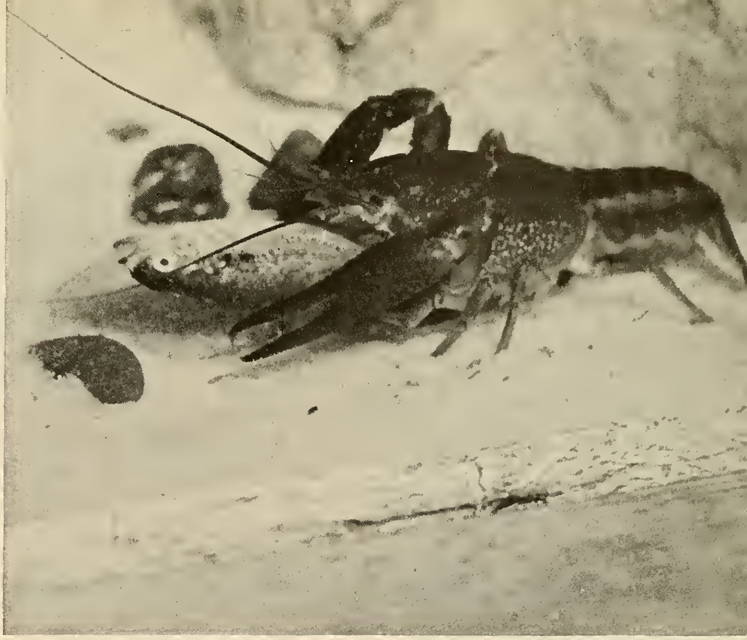
Continued from page 385

for his own use and that of his immediate family."

4. **Why can't the bald eagle be protected instead of a bounty being paid on it?**

The Secretary of Interior could give the bald eagle legal protection if he wished. At present the bald eagle, along with the golden eagle, with which it is frequently confused by Alaskans, is left unprotected along with all the other members of the hawk and owl group. Under the provisions of Section 46.151 it is provided that there shall be no closed season on crows, hawks, owls, eagles, ravens, magpies, and cormorants, and their nests and eggs, except in a national park, monument, or posted national forest area.

The bounty on the bald eagle is paid by the Territory of Alaska under a law enacted by the Territorial Legislature for reasons that are not at all clear except that the role of predatory forms of wildlife is not as a rule very well understood in pioneer communities like Alaska.



Emil Liers photo

▲ A CRAYFISH eating a bass fingerling. In this way, the fisherman is sometimes frustrated by the crayfish. Otters, though they are often blamed for the damage, will actually hold the crayfish population down and preserve a better balance for the angler

5. **Is such an ill-advised policy advocated by the personnel of the agency in question?**

The placing of a bounty on the bald eagle was not advocated by the personnel of the Fish and Wildlife Service, and at least some members of that Service undertook to do what they could to advise against the passage of the Bounty Act. The Secretary of Interior, however, has to date failed to take the steps that he could take to stop the killing of these birds if he was convinced of the correctness of the Fish and Wildlife Service's stand against the bounty.

6. **Are the personnel this agency does have inadequately trained?**

No. The Fish and Wildlife Service have some well-trained men on their Alaska staff. Primarily, what they need is more trained men, especially men trained in ecology. Alaska covers a vast area, and as yet they have a wholly inadequate staff for the job they are supposed to be doing.

7. **If the personnel of this agency are not to blame, who is?**

You and your fellow citizens. You should convince the Secretary of Interior that he would have the whole-hearted backing of the country if he told the Alaskans that he was placing the bald eagle under protection and that any further killing of it for the bounty would be illegal.

8. **What, if anything, are the officers of public and private conservation organizations doing to see to it that the agency involved is provided with sufficient authority, the right number of properly trained men, adequate equipment, and funds?**

The Secretary of Interior submits a budget each year to Congress in which he asks for funds for the work of the Fish and Wildlife Service in Alaska. This is all he can do. To date, the private conservation organizations of the country have not stimulated sufficient interest in the matter to induce Congress to appropriate the needed funds.

9. **Are they depending merely on response to magazine articles—on scattered letters to Senators and Representatives—to carry the field in Alaska; haven't they formulated a definite, ecologically sound policy for which they are actively seeking public support?**

The answer to the first part of this question is yes. Everyone agrees that the Alaskan situation is a bad one, but the country's various conservation organizations are all busy with other programs of long standing and at best are giving only casual attention to the Alaskan situation.

10. **Has a bill embodying a sound, long-range conservation policy for Alaska ever been introduced into Congress?**

The answer to this question should probably be no, as to some extent we lack the basic scientific data for such a policy, and comparatively little is yet being done to obtain that data. There is a bill in Congress, H.R. 1870, that would extend protection to the bald eagle in Alaska through an extension of the law that now protects it in the United States. The basic reason this has not been passed is again that you and your fellow citizens just haven't convinced Congress that you want it passed.

11. **Cannot the leaders of the numerous private conservation organizations at least co-operate to the extent of devising some efficient mechanism for the *organized expression* of public opinion on conservation matters, so that real *pressure* can be brought to bear at the right place at the right time?**

They probably could if someone were to offer to provide the funds that would be needed to finance an adequately staffed co-ordinating office on Alaskan affairs. Such an office could continually point out to the people of the country and to the conservation organizations what they should be doing about Alaska. It should have sufficient funds to publicize its findings and recommendations, and it should have a staff persistent enough to see that their recommendations were eventually put into effect. It would be desirable for this Alaskan conservation affairs office to be in a position to circulate, as spurs to action, urgent items on what is happening in Alaska, based on firsthand research findings of their own men.

Continued from page 396

are signs of concern. Perhaps, some say, the campaigns to destroy him were a bit too vigorous. Perhaps the bill against the wolf contains some unfair particulars. At any rate, quieter, more rational voices are being heard in the Grand Jury room.

One of these belongs to Dr. Olaus J. Murie, retired Federal biologist, and now president of the Wilderness Society. Dr. Murie believes the estimate of 1000 remaining gray wolves indicates danger of extinction. He believes steps should be taken to save this "picturesque element of the wilderness."

Dr. Clarence Cottam, Assistant Director of the U. S. Fish and Wildlife Service, states that wolf control is no longer necessary and adds, "We would hate to see this magnificent animal disappear."

It is almost too late. The wolf is outlawed nearly everywhere except in the National Parks, and the problem is to find him a sanctuary without stirring up cattlemen and sportsmen.

The apparent solution—use of the big National Parks—is virtually ruled out owing to the wolf's vast hunting range. Big as many of the parks are, they are too small to contain wolf migrations. Yellowstone, for example, is surrounded by cattle country. In winter, the Park game migrates down from the mountains and into the surrounding grazing land. Wolves would follow the game, and cattle depredations would probably result. A soon-to-be published study by the Fish and Wildlife Service shows that about one-half of the Yellowstone coyote population moved out of the Park in winter, and only one-half that number returned. One coyote, tagged in the park, was picked up 115 miles away two years later. Wolves migrate farther than coyotes.

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Olympic National Park in Washington State would be a more likely wolf sanctuary, except for the protests of sportsmen. There is little cattle raising in the area, but there is game, and hunters argue that wolves would follow the game out of the Park and into their preserves.

The most practical suggestion seems to be that of Dr. A. M. Stebler, of the University of Michigan's laboratory of vertebrate biology. At a recent session of the North American Wildlife Conference in Milwaukee, he suggested Isle Royale National Park in Michigan as a "good possibility."

Isle Royale is a 210-mile stretch of heavily forested wilderness surrounded by the waters of Lake Superior and containing a surplus of game, particularly moose, all protected by law. There may be wolves there today but not in any number. Dr. Stebler suggested that the island offers "an interesting and excellent opportunity to follow through with a study of predator relationships, wherein both relations [prey and predator] are reasonably restricted geographically." He thought Isle Royale offered a natural refuge for the remnants of the Great Lakes' wolf population and the chance to determine what controls on the island's game the presence of a wolf population would offer.

Conrad L. Wirth, Assistant Director of the National Park Service, is inclined to agree with Dr. Stebler. However, Wirth cautions that the introduction of wolves on Isle Royale would have to be on an experimental basis at first. Too many might threaten even an overabundant moose population. But a limited number of wolves would be actually beneficial, since the moose now are so numerous they are eating themselves out of house and home.

In spite of these arguments, there remains some opposition to the introduction of wolves in Isle Royale. Aside from the possibility that they might leave on the ice some severe winter, this island, without wolves, offers a good opportunity to study a game population with no natural controls. There are arguments for and against.

Seemingly, only one more possibility for a wolf sanctuary exists in this country—the Superior Roadless Areas in which both the United States and Canada have an interest. (The Canadian area is called the International Peace Memorial Forest.)

The portion in the United States consists of 1,038,000 acres of wilderness in the northeast corner of Minnesota along the Canadian boundary. It is under the jurisdiction of the U. S. Forest Service. It is natural wolf country, and again there is plenty of game. But under Forest Service policy, the game belongs to the State, not the Federal Government, and Minnesota permits hunting in season. That raises the ancient objection that hunters have against the wolf. There are a few wolves in the area now. Forest Service officials suggest that more wolves be introduced and that they be made game animals, in season, to placate the hunters. The wolves would also serve as a natural balance for a surplus deer population in the remote areas of the wilderness, where hunters seldom go.

In summary, it seems fair to conclude that the gray wolf has an honest claim to existence. No one seriously argues that he is any longer a real threat to livestock or game in this country. He is a traditional and romantic figure in our history; he is one of the few remaining memorials to America's once unspoiled wilderness. Those who love the wilderness should still be allowed to see wildlife, both prey and predator, in natural distribution. The sight of a gray wolf loping through the forest on his ancient quest, or the eerie, thrilling sound of his lonesome howl before daybreak, ought to persuade men that their hearts can still respond gallantly to the call of the wild.

December

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OLUME LX No. 10

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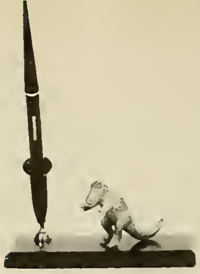
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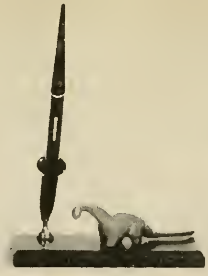
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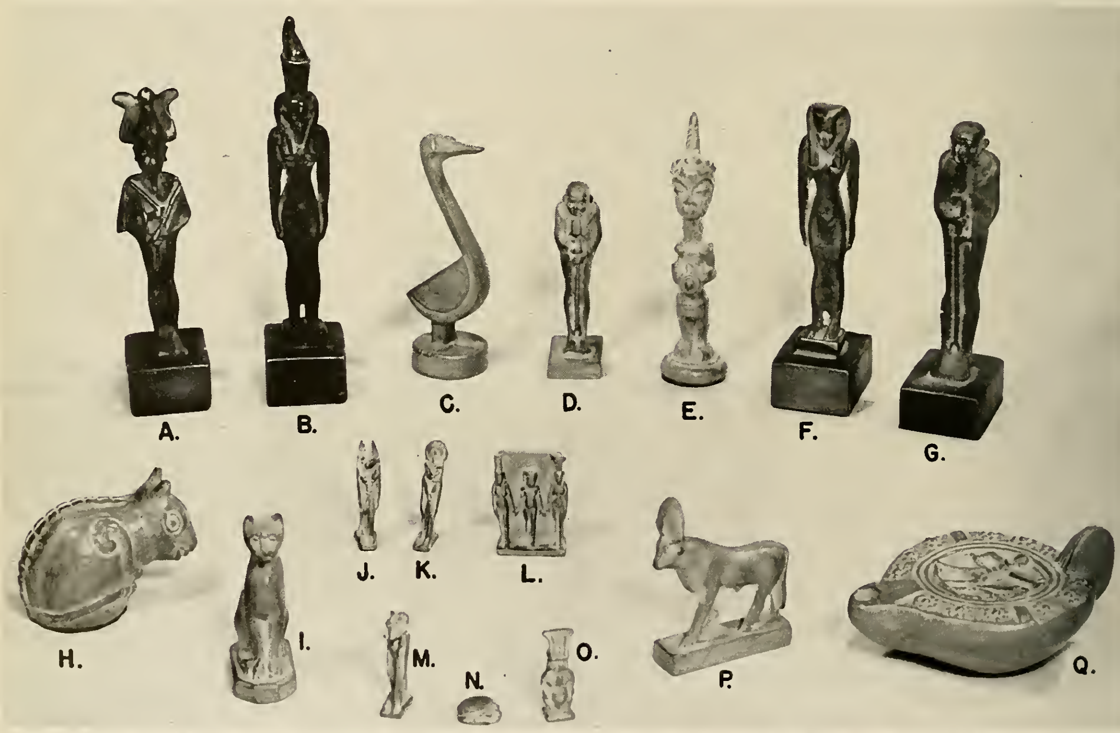

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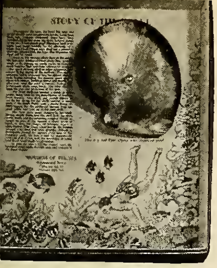
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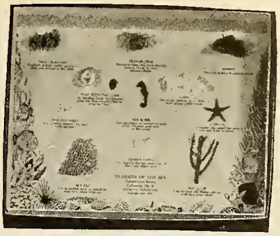
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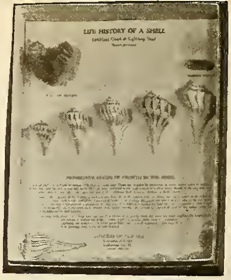
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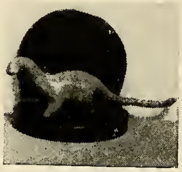
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L E T T E R S

Forests and Men

Sirs:

In the October issue of Natural History Magazine, we have just read Willard G. Van Name's review of the book *Forests and Men*, by William B. Greeley. In our opinion this review is unfair, inaccurate, and a disservice to the cause of forestry in the United States. Some of the reviewer's statements are so contrary to facts that we feel it necessary to call them to your attention.

First, we would like to comment on the author's claim that political and commercial domination of the Forest Service, the bureau established to manage the National Forests, soon put an end to hopes that the system of government forest reserves would bring profit to the nation and avert a future timber famine. The National Forests as they exist today certaintly refute that claim. To our knowledge, even our severest critics have never made such a charge of political or commercial domination as does Dr. Van Name. We in the Forest Service are extremely proud of its record and challenge any such statements.

The reviewer goes on to say that the Forest Service has not only never shown a profit but that it has been a heavy expense to the nation every year. We wonder if he is familiar with the fact that the National Forests last year returned to the U. S. Treasury several million dollars more than the total of all appropriations for their operation and management. The National Forests, indeed, are now not only paying their own way on a cash basis but are yielding returns in public benefits, such as watershed protection, recreation, wildlife habitat, and other contributions to local and national welfare that are of inestimable value.

Another claim which certainly should be challenged is Dr. Van Name's assertion that the magnificent stands of timber that many of the National Forests used to contain have been entirely made away with. He entirely omits any reference to the fact that on many National Forest areas that were cut-over and burned-over lands, where there was little or no timber at the time of acquisition, regular timber crops are now being grown. He also overlooked the fact that there are still some 44 million acres of virgin timber in the United States, and the bulk of this is within the National Forests. It is true that on much of this area the timber is overmature and deteriorating because of inaccessibility for harvesting. It should be noted, however, that the Forest Service requires that all timber harvesting in the National Forests must be in accordance with sustained-yield principles that provide for continuing forest growth. Within the National Forests also are 14 million acres designated as permanent wilderness, in which no timber cutting is allowed. The total acreage of virgin timber in the United States, incidentally, is about eighteen million acres greater than the total area of all the National Parks put together. This is said without any reflection on the National Parks and their values to the American people.

We wonder just why Dr. Van Name objects to using forests in the United States for the wood products, which only they can provide. Foresters believe that research for finding new uses for wood is one of the best tools for better forestry in this country. New uses for wood help to encourage the growing of timber as a permanent enterprise. Greater utilization means more incentive for sound forestry.

Col. Greeley's claim that regrowth of our forests now nearly equals the drain on them is a true statement of fact when one considers total forest growth. Unfortunately that same claim cannot be made for saw timber, our most valuable type of timber, where according to the most recent surveys the drain is about 50% greater than growth. Col. Greeley makes mention of this condition in his book. Incidentally, that same survey showed that we have ample forest land areas in the United States to meet any foreseeable demands for forest products, provided that land is kept reasonably and continuously productive. So far as can be determined there is no indication that the total area is decreasing to any great extent. The Forest Service is devoting its full efforts to the encouragement of sound and wise management and use of that land in the interest of national welfare.

Lyle F. Watts, *Chief*
United States Forest Service,
Washington, D. C.

Natural History Magazine is glad to publish this expression of U. S. Forest Service policy. With the drain on saw timber admittedly 50% greater than growth and with our last remaining virgin timber down to 2½% of our total land area, Natural History would like to do something further. We would like to publish photographs, with information as to location and size, of the six finest forests remaining under U. S. Forest Sersive jurisdiction for whose protection the Forest Service needs continued public support.—Ed.

Sirs:

. . . My subscription ran out while I was ill this summer. Will you kindly accept my renewal check for the finest magazine of its kind in the world.

Lillian Cox Athey,
Publisher and Editor.
National Nature News,
Washington, D. C.

Sirs:

. . . I would like to take this opportunity to express my appreciation of your fine magazine. It is unsurpassed in its field and would compare favorably with almost any magazine printed.

Terence W. Belshaw.
San Antonio, Texas.

Dr. Eugenie Clark Back from Red Sea Expedition

Dr. Eugenie Clark, whose "Field Trip to the South Seas" readers will remember in last January's Natural History, has just returned from Ghardaqa on the Red Sea in Egypt. At an isolated spot on the edge of the desert, the 29-year-old Research Associate of the American Museum's Department of Animal Behavior made the first detailed study of Red Sea fishes in 70 years and assembled the largest collection of these fishes ever made by a single person. Dr. Clark was a Fulbright Research Scholar at the Marine Biological Station of Fouad University.

She will write of her work on this expedition in a coming issue of Natural History.

Key Deer Bill Deferred

The bill to provide a much needed refuge for the Key Deer (H.R. 2897) is still in Committee because of certain local objections. The special protection that the deer have enjoyed this year, thanks to the Boone and Crockett Club, cannot be continued indefinitely. And eight animals—one-fifth of the remaining population—have apparently been killed by motor trucks. Fencing at strategic points, impractical until a refuge is established, appears to be essential. Persons who feel that action should be taken promptly should write to the chairman of the Sub-committee on Fisheries and Wild Life Conservation, Congressman Frank Boykin, House Office Building, Washington 25, D.C. and to their own Congressman.

NATURAL HISTORY

The Magazine of the American Museum of Natural History

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In charge of Publications
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DECEMBER, 1951

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You will find NATURAL HISTORY Magazine *indexed in* Readers' Guide to Periodical Literature *in your library*

THE COVER THIS MONTH

The spectacular scarlet to vermilion flowers of this Passionflower *(Passiflora vitifolia)* enliven the somber depths of tropical forests from Nicaragua to northern Peru. It is abundant in Panama and Costa Rica, where this picture was taken by Paul H. Allen.

About 400 species of passionflowers are known, mostly from the New World, but a few are native to Asia and the South Pacific islands. Usually they have small greenish or yellow flowers, but a number of fine red ones are known, as well as the large blue types commonly seen by travelers in the West Indies. Residents of southern United States know the maypops *(P. incarnata)* as a common weed in fields.

Early Spanish explorers saw a resemblance to details of the Crucifixion in the peculiar structure of the flower of some tropical species, and this gave rise to both the popular and scientific names. A good many kinds are grown as ornamental vines in European gardens, and at least two species provide the tropical fruits known as granadillas.

H. K. SVENSON.

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YOUR NEW BOOKS

Edwin Way Teale: North with the Spring
Bay • Human Fertility • Travel • Man

NORTH WITH THE SPRING

- - - - - - - by Edwin Way Teale

Dodd, Mead & Co.,
$5.00, 366 pp., 35 illusts.

SPRING is the high tide of the year, when life comes streaming back to reanimate the scene left desolate by winter. Yet so often the swift transition of spring into summer robs us of its many-sided significance. To capture its elusive charm more completely one must travel with it as it rolls northward through regions of natural beauty, and that is precisely what the author has done. The journey begins appropriately in what is described as a no man's land of the seasons, the Everglades, and moves northward – not always perpendicularly but with interesting crisscrossing of territory to include localities of unusual appeal – until it terminates near the summit of Mount Washington. There an exhausted spring, robbed of its pristine freshness after the long upward climb latitudinally and altitudinally, becomes the counterpart of that season in, let us say, Labrador.

To travel with Teale on the crest of the wave of spring is an exhilarating experience. His joy in the natural scene and his vigilance in detecting its denizens, large or small, assure a constant succession of interesting observations and records of happenings, and these are set down so vividly that the text has as much pictorial quality as the excellent photographs that supplement it.

In the brief space available for this review it is impossible to give more than a hint of the varied and informing content of the volume. Birds are everywhere throughout its pages, singly like the beautiful painted bunting or in great waves such as were witnessed when the migrating warblers poured over the Appalachians. Migrations were not of birds alone. The return flight to the north of the monarch butterflies and the landward migration of the baby eels from their birthplace in the distant ocean depths are narrated with informing comment. There is a chapter devoted to the capture alive of Florida diamondback rattlesnakes. Plants are as ubiquitous throughout the volume as the birds, and a particularly interesting chapter is devoted to those of insectivorous habit, with accounts of certain insects that are adapted to life within the dangerous confines of the plant.

One hesitates to assign pre-eminence to a particular volume in a sequence where each volume has distinctive merit; yet many a reader may feel that in *North with the Spring* Teale has edged even above the high level established by *Grassroot Jungles* and his subsequent publications of comparable stature.

HERBERT F. SCHWARZ

THE BAY

- - - - - - - - - by Gilbert Klingel

Dodd, Mead & Co., $4.00, 278 pp.,
numerous spot drawings

THE title of this book might well have been "The Incredible Chesapeake," the heading for the first chapter. The Bay is brought to our senses and our mind in all of its varying moods and phases by a naturalist with a gift for expressive writing. All who remember Klingel's *Inagua* will welcome this successor, for he gives the same freshness of description here to the life above and below the surface of the Chesapeake that he gave to a lonely and forgotten island of the Caribbean. Much of the present book relates the experiences of watching by night the strange life of the sea floor of Chesapeake Bay and in the water above—a fantastic world seen under eerie conditions. Luminescent creatures, both burrowing and drifting, naturally call for and get attention, but so do those wanderers of the sea floor who pass their own quiet lives with less advertisement. Their birth and growing and their im-

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Strangest of
all adventurers
in the early
American West
were the naturalists

● They suffered pain and privation without the army officer's hope of promotion, or the fur trader's dream of wealth...and they ventured alone where wiser frontiersmen did not choose to go.

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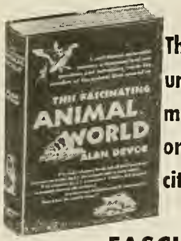

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portance even in death are discussed with insight and feeling.

Above the waterline the sand, the toy of wind and current alike, forms the universe of ghost crabs and fiddlers, and Klingel brings it vividly before our eyes. The finest writing concerns the borders of the Bay, and the chapter on the Chesapeake marshes is a superb piece of word painting in which the world of life is both seen and heard as the tide ebbs and flows, and day passes into the long night and the dawn that follows. Ospreys, Bald Eagles, Blue Herons find their place in this charming book, as well as the marine creatures which dominate it, while the chapter on "The Bay in Time" puts it all in its setting with the past. The sketches by Natalie Davis add considerably to the attractiveness of the book.

N. J. Berrill

THIS FASCINATING ANIMAL WORLD

- - - - - - - - - - by Alan Devoe

McGraw-Hill Book Co.,
$3.75. 303 pp.

THIS book is written on a question-and-answer basis. It covers a very wide field, treating questions that are likely to occur to the average reader and, in addition, some that are not. The author displays an extensive background of observation and study in providing the answers and a journalistic flair that, on occasion, throws a strain on the credulity of the reader.

Devoe has a complex on formal naturalists, the museum men, and students of natural history who work on it as a profession. As one of this group, I frankly confess it irritates me to read the frequent aspersions and charges laid against us. I admit we naturalists are hard to convince, we are dull as ditch water in much of our research literature, and there is a great deal for us to learn. Devoe has created the term of "animalizer" to describe his own particular field of competence. I am sure the run-of-the-mine naturalist will be agreeable to the segregation. It should be stated that "animalizer" connotes an iconoclastic philosophy toward much accepted natural history and a tendency to create straw men (exemplified by "Prof. X") in the professional field.

It is unfortunate that the review of this provocative book must be confined to such brief space. Chapter and verse should be cited to support the criticism of the reviewer. Much of what Devoe writes in this book will meet with the approval of all readers. He has interesting topics, and his breezy style holds the attention of the reader. It is scarcely necessary to give examples of this.

The items that cause a difference of opinion can be exemplified by "Can porcupines throw their quills? No." "But may you be standing 10 feet from an agitated porcupine and nevertheless get a quill whizzing through your hat? You may." It is difficult for me, having been so situated many times, to imagine the loosened, very light, quill *whizzing* anywhere. It tumbles every which way and its velocity at a distance of 10 feet, and the likelihood of being point-on to go through your hat—? I give up. I guess I was not cut out to be an animalizer.

Harold E. Anthony

THE FALL OF THE SPARROW

- - - - - - - - - - by Jay Williams,

with an introductory chapter by Stanley Edgar Hyman

Oxford University Press, $3.00
158 pp.

THE extinction of species has been going on for hundreds of millions of years, but it is only recently that Man has become especially concerned with this phenomenon. This is the result of his increasing awareness of the part he has played in the decrease and even in the disappearance of various forms of life, for within historical times, and especially within the last century, destruction by man has become unprecedentedly severe.

The dismal story is told in some detail by Mr. Williams, and one must admire the amount of work that has gone into the compilation of his book. This is a series of case histories dealing with the extinction and the extermination of many species of animals, and throughout the account Man plays the role of the arch-despoiler. Mr. Williams is concerned especially with the retreat of animal life before the onslaughts of comparatively modern humans. It is a long catalogue of sins, including at its end an account of the struggles between men, during the course of which quite a few ethnic groups have vanished as a result of pressures by their aggressive brothers. As a counterbalance to his compendium of death and destruction, the author devotes one chapter to a description of the work being done by modern conservationists in an effort to save species now threat-

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ened and to put to rights an upset balance of nature.

The book will be useful to a public that has become aware of the importance of conservation in the modern world, but it may give a somewhat unbalanced picture to the general reader. The author is aware of the fact that extinction has been going on for a long time—but this point is not sufficiently stressed. Many of the species given the final crushing blow by Man were on their way to extinction anyway. However, it is well to emphasize the impact of modern Man on the life around him.

The book is written in a style intended to be light and amusing but which unfortunately succeeds in being for the most part annoyingly flippant.

Edwin H. Colbert

I CANNOT REST FROM TRAVEL

- - - - - - - - - - by Willard Price

The John Day Company, $4.00
313 pp., 15 photos

IN youth he meant to become a minister. Then adventure in Canada and a brief spell of circuit riding in Ohio taught Willard Price he must first learn more about the world. As a "printer's devil" in New York he earned the price of a steerage ticket to London. On this shoestring began the career of a globe trotter who dreamed of a better world.

After cycling across Europe and returning to New York amid a shipload of Italian immigrants, Price realized he must study journalism. Columbia University rewarded him with an M.A. in 1914. After launching a journal, *World Outlook*, he began a tour of Japan, Korea, and China.

Those were only the first of 70 lands covered in a lifetime of reporting. Besides numerous articles in many periodicals, he wrote more than a dozen informative books. Willard Price writes with skill, insight, and humor. His greatest interests lay in the Far East and Latin America; China and Japan were visited repeatedly; the Indies, Philippines, Micronesia, and North Africa not neglected. He braved the ire of a Moroccan Pasha, outsmarted the Japanese, and in Mindanao consorted with a killer of renown.

The Second World War caught the Prices in France and prompted the reprinting of *Japan's Islands of Mystery* as a source book for strategists. Later Price was studying the new air route across Amazonia, head-shrinking by Jivaro Indians, and animal collecting on the upper Amazon.

These segments from an active lifetime of travel are colorful, amusingly presented, occasionally almost tragic. The author abandoned dogmatism for a warm appreciation of all humanity. Yet his closing note is pessimistic: has our world really progressed in the past half-century? Surely it has. The broader knowledge of our globe, its life, of the structure of the universe, is well worth all our pains. To a better understanding of men and nations Willard Price himself has contributed abundantly.

James P. Chapin

HUMAN FERTILITY
The Modern Dilemma

- - - - - - - - - by Robert C. Cook, with an introduction by Julian Huxley

William Sloane Associates,
$4.50, 380 pp.

A LITTLE over 150 years ago an English clergyman by the name of Malthus wrote a book best known by its short title of *An Essay on the Principle of Population.* The strange paradox about this remarkable work is that although few books since its publication have had greater influence, yet its lessons have been very largely minimized. Malthus pointed out that population tended to increase up to the limit of subsistence. The balance between population and food was achieved only by catastrophic destruction of masses of men through famine, pestilence, and war. In Malthus' day the approach of population to its limit of subsistence provided him with abundant examples of human misery and suffering.

Continued on page 475

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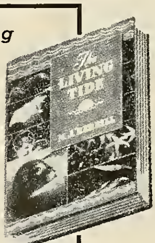

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The Mout

A firsthand account of a strange adventure in the black jungles of Dominica—where prodigies of nature meant danger and death to more than one

SOMEWHAT over 100 years ago, an inhabitant of Dominica, British West Indies, decided to traverse the jungles of a little-known section in the southern half of the island. Swinging his cutlass, he hacked himself a path through the dense growth until he was many miles from any known locality or habitation of man.

For hours he pressed on, confident that he would safely come to his destination, but he ascended this peak and descended that ravine, crossed torrents, circumvented cliffs and precipices, without reaching his goal.

Finally he realized that he was lost. He was in the midst of a green jungle, where trees reached with tops unseen to dizzy heights above his head, where long thick lianas hung like snakes from branch to ground, and where the space between the tree trunks was choked with myriad plants, ferns, mosses, decayed and rotting wood, and all manner of tangled growth. He could see but a few feet ahead, and little sunlight filtered down through the thick matting of leaves. He listened, but there was only silence or the gurgling tinkle of a close-by rivulet. Then night closed upon him.

He slept a little; day came, and once more in a somber green maze he wandered, deriving a little subsistence from roots and herbs. Thus nights came, days passed, strength oozed away, death approached him. Finally he thought he heard a sound, like the ringing *whack!* of an ax blade striking a tree. He shouted and was answered, and soon help was at hand. Emaciated, ragged, he had blundered back nine days later to the place from which he had started. When at length he recovered, people questioned him about his experience. What had he seen that was new and of interest in that unknown region of the bush? He answered that he had seen nothing except the everlasting tree trunks, the dangling vines, the dark green riot of vegetation, a few small streams. Yet, there had been something that he had heard in his wanderings, something awful and terrible as of a great roaring far off, and there had come at times a sulphurous smell. Then he had heard it no more, but the sound had increased his fears, for the roar was menacing.

This statement aroused some curiosity and conjecture but no action. Living was hard for most of the colonists, and they had little time to wander in the jungle to seek for something that was not gold. A generation passed, and the story was all but forgotten or thought to represent the vagaries of a lost and half-demented man. Furthermore, the ignorant and superstitious feared to penetrate that bush, for there must be ghosts, demons, and *soucouyants** in it. At length, a more bold and enterprising citizen, with some leisure and a keen sense of curiosity, heard the old tale. He decided to investigate and organized a small expedition. He *found* it! But then, I too found it.

At three one afternoon, I was swinging down the pavement of one of the streets of Roseau, the island's little capital. On my back was a rucksack containing a few necessities and provisions. I was hiking to the hamlet of Laudat six miles distant, where I intended to spend the night before plunging into the mountainous jungle, which contained the famed, little-visited, and mysterious object of this trip.

Crossing the bridge, the first three miles followed the Roseau Valley. This was easy, for it was neither steep nor hot, and it was pleasant to plod along admiring the scenes, listening to the birds, and enjoying the greetings of the natives passing by.

At length the road began to climb. It went up and up, switchbacking in zigzags every few hundred yards and blocked by landslides in many places. More miles, and the route flattened out into a plateau region, and there was Laudat — a tiny hamlet of scattered cabins, little clearings for fruit and garden truck, a tiny church, and a rough clapboard miniature of a building that called itself a store. Here was where I was to stop, and an inquiry directed me to a resthouse kept by one Agnighta Rowle.

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* Vampires that take the form of a huge moth or firefly and suck the blood of sleeping victims.

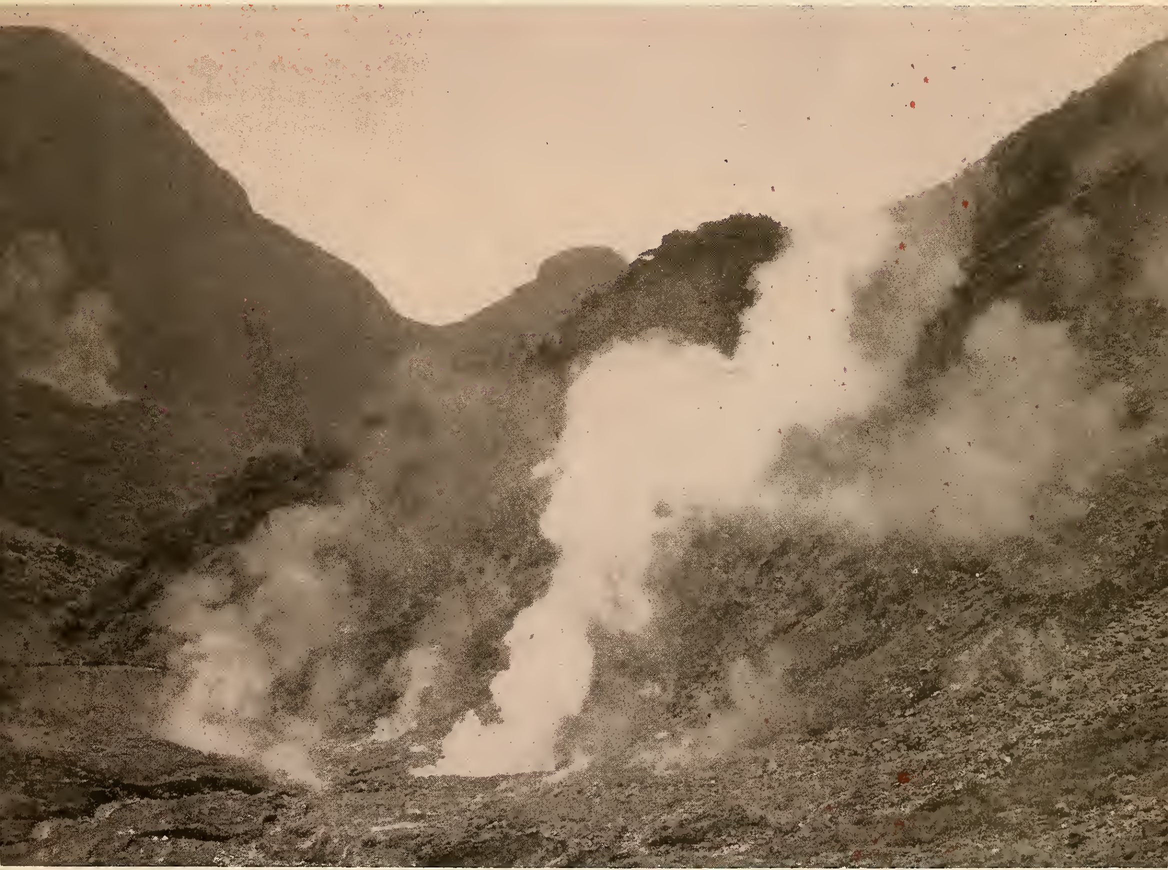
Agnighta—"Little Lamb"—proved to be a pleasant-featured young colored woman. With evident pride, she showed me her resthouse, which consisted of a kitchen, a dining-sitting room, and three small bedrooms. There was a porch, and though the cabin and its rooms were tiny, all were swept, scrubbed, and spotlessly clean.

A simple supper and an early bed, but after three hours I awoke. Perhaps it was the cold, for Laudat is 1800 feet above the sea and I had but a sheet over me, but perhaps it was something else. At any rate it was quite light, and I went out onto the porch to look around and smoke a cigarette.

It was the time of the full moon, and the great disk was riding high in the dark sky, revealing the earth almost as in daylight. There lay the moonlight on the clearings, casting shadows of branches like lacework, and the cabins half in silver, half in darkness, the somber background of the jungle, and the country sweeping downward, to where it met the starlit sea. At my back, hanging right over the village, loomed a vague and velvet-dark immensity—mighty Morne Microtin, a jungle-choked, dormant volcano, whose top they say has never been

f Hell

By Stuart E. Elliott


▼ A PORTION of the Valley of Desolation, with vapors from the boiling lake rising in the background at left

▲ THE PICTURESQUE PORT of Roseau in the island of Dominica, in whose wild interior the events narrated in this article occurred

▲ AGNIGHTA and the guide Cyril Rowle at the Rest House

▼ A STREET in the capital city of Roseau

explored. All was peaceful and quiet, save for the sounds of the insects. Then, these were hushed and the silence was complete.

Suddenly, as if from afar, there came a deep rumble – faint yet great. It grew in intensity like the sound of an approaching train, and then the ground began to rock and the house began to sway. At first gently, then harder, until the beams creaked and cried, and the cabin rocked. In a short time it was over, with no damage; but it seemed that the quiescent, fire-belching demon beneath these mountains had stirred a little in his sleep.

The next morning, I was up with the rejoicing birds. After breakfast, Cyril Rowle, Agnighta's brother, who was to be my guide, came over. He was a medium-tall, wiry and intelligent-looking mulatto of around forty, who had a regular job with the Public Works Department of the island; but Laudat was his home, and no one knew the interior jungles better than he. The colony's administration had licensed him as a guide for such regions.

Cyril had with him a younger Negro, as porter for our trip. The contrast was marked. The guide's clothes were neat; he wore shoes, and his bearing had the grave dignity of one far above the ordinary countryfolk. The porter was a shuffling, grinning black, raggedy and barefoot.

Cyril cut us two long pilgrim staffs, and we set out. For a mile we followed a tolerable trail, well used, since we were still among the sugar canes and banana bushes of the villagers. Then the trail dwindled to a faint trace, and the gloom of the jungle covered us. This path was rough and hard to follow. There were sharp rocks and slippery stones, and the space between was mud, with frequent sloughs and quagmires from the constant rains and showers. It was uncertain footing from the start.

Another mile, and we came to a place in a deep glen where a mighty mountain chestnut had crashed to bridge a dreadful chasm. This was Titou, a gap not more than twelve feet wide but of a fearful depth. Gripping the rough handrail, I ventured onto the fallen trunk, then stopped and peered down into a blackness. Close to each edge and arching over grew thick bushes; but parting them, one could see a gash with perpendicular walls, and far down–120 feet by plumb line–the white gleam of a torrent. This stream was like a shining hacksaw, deep in some cut of gray iron. It was like looking into a rodent ulcer, gnawing deep into the skin of the earth. Yet the bushes all but utterly concealed the gap, making a trap for the unwary.

"Cyril," I said. "Has anyone ever fallen in?"

He considered. "No man I know of," he answered, "but my poor dog did. He was a good dog, but he slipped on this log and fell. He fell straight without glancing either side and reached the water alive. I flashed my light and saw him try to swim, and he barked for help, but the current swept him quickly down."

"And then?"

"I tried to follow along the top, in hope the stream would surface not too far away. But I could not go fast enough, and I never saw my dog again. I think a whirlpool got him, or else he went over some high waterfall before he reached the river. I was very sorry he died."

▲ A SECTION of the infernal gulch. The author is at the far right

▲ A REST on the way down to the boiling brook

"But," said I, "you could never expect any sort of chance from that awful place."

"You think not? Listen! A man I know had a worthless dog, a chicken killer, so he took him here and threw him in. He, too, fell without touching the sides and struck the water quite alive. Then this man went home thinking he was well rid of him, but when he reached his house, the dog was there waiting for him, and no bones broken. He was a bad dog, but he was a strong swimmer."

This was Cyril's tale, and one thought, "like men like dogs," the bad penny turns up.

We trod on for miles through the green gloom of the jungle. Surefooted, cutlass in hand, Cyril strode ahead. He knew every rock, every projecting root on the trail, and he did not slip or catch his foot. Behind, I came in rubber-soled shoes that slipped like soap on the rounded, glistening stones and had little grip in the viscous mud. At our rear pattered our porter, who never slipped. His soles were a half inch thick with callouses and were as tough as a tapir's hide; and his toes, unwarped by any artificiality, were broad and straight and widely spread. When he stepped on a slippery rock, his toes curled around the edge and gripped almost like the clutch of a bird.

Another hour, and there was a natural clearing, where a landslide had wiped the forest from the slope of a steep ravine. We descended, and for the first time there came a faint sulphurous smell. Cyril nodded and halted beside a little stream. "Hear anything?" he said.

"Like a roaring, way off? But I am not sure."

"That's it. Today it's rather quiet. Sometimes it's like a lion."

"We must be getting near."

"Two hours more of trail. Tired?"

"Me? Never! Let's go." We

▼ ALONG the rugged trail between Roseau and Laudat

▲ A WATERFALL along the trail to Laudat

crossed the stream that split this gulch in two.

But now our trail, so far no easy path, became far more arduous. A green wall faced us, and up we went. Up and up, at an angle of 60 degrees or more, and here we needed handwork as well as footwork. Anyone who follows this trail needs tough muscles, for there is work such as Jack did climbing his Beanstalk. Bending our legs repeatedly until our knees met the level of our chins, we grabbed roots and snatched bushes, while underfoot the mud was oozy and a pattering drizzle on myriad leaves dripped rain upon our faces. We climbed and climbed and climbed again, and kept on climbing.

At last we reached a kind of semi-level and followed a gradually rising ridge. This was not over 4 feet wide, with precipitous slopes descending some 1500 feet, until they ended in an uninterrupted green maze far below. Across this razor-backed trail, we came upon the skeleton and feathers of a bird.

"Wild cat!" said Cyril, turning over the remains with his toe. He then spoke of the animals of this jungle. There were the agouti and the deer and the cats. These last were many generations removed from their domestic forebears and had grown large and powerful in their savage state. There were also once-domestic sheep, now ranging wild, and there were goats and wild cattle; the latter could prove ugly customers on occasion.

However, the only really dangerous animal was the pig—runaway descendents of domestic swine—and they were numerous. The boars had developed into ferocious, shaggy creatures, armed with long razor-sharp tusks. Unmolested, they avoided man; but when hunted with dogs—an island sport—they charged like lions. Many dogs were killed on these hunts, and men, too, sometimes.

We noticed hawks and once glimpsed a flash of something red and green that might have been the famed Imperial Parrot, a bird seldom seen. It is a fine large bird found only in Dominica—indeed, only in the most inaccessible fastnesses of the island. Then a small green snake slithered across our path. We paid small attention to it, for although there are twelve-foot boa constrictors on Dominica, they are rarely seen and are mere harmless chicken stealers. There are no poisonous snakes—which is a comfort when traversing the Dominican jungles.

On near-by Martinique, not 30 miles south over blue waters, the deadly fer-de-lance lurks everywhere—in jungle, kitchen garden, and even in the heart of town after nightfall—and his fangs are worse than any rattler's. Why in all the years that the fer-de-lance has terrorized the barefoot inhabitants of Martinique, it has never crossed the channel as a passenger on driftwood seems rare good luck, especially as it has been found secreted on small boats plying between the islands.

Our hogback trail now turned a bit more sharply upward. Another ten minutes and we came to a place where the trees had given way to low shrubs, over which we could peer into the distance. We stopped. We were on the topmost point of Morne Nicoll, 4000 feet above Roseau and the sea. Here the peak was no more than 5 feet square, and on all sides the slopes descended from 50 to 60 degrees, until they

▲ THE AUTHOR and his companion after a third trip to the Lake faded away in the green immensity far beneath. We were like three microbes resting on a needle point.

Cyril stretched forth a lean, brown hand. "Do you see?" he pointed. Everywhere a confusion of high, steep, conelike peaks; everywhere acutely apexed pyramids, green for the most part, save where a landslide had left great red and yellowish scars on some steep flank. They looked like drawings of mountains done by children — verdant cones, shaped like ice-cream sellers' cornucopias, like the naive illustrations in Van Loon's *Geography*.

There was no order in them, and unlike the calm and steadfast grandeur of our Rockies or White Mountains, these hills seemed insane in both shape and confused array—a jumbled assemblage of dormant volcanoes. However, it was not to this weird picture that Cyril was drawing my attention. These slumbering, crazy-looking peaks only formed a sort of ring, a crowding irregular ring, like gapers at some dangerous object.

Below our feet lay a valley, or rather two valleys, for low spurs and obstructions somewhat divided it in two. At the end of the farther part rose a billowing cloud of steam. Then a wind seemed to rip this asunder, and I glimpsed a smutty, blackened cliff that curved concavely as if it were the inner side of a gigantic stewpot. As a bird might have flown, if any birds ever flew over that region, it seemed a mile or so away.

"So that's it?" I said, and Cyril nodded. "Well, it can't be long from here."

"It will take a good hour," he said gravely. "By far the worst is still ahead."

We now descended. Our route was a six-inch gutter of mud and treacherous stones which zigzagged back and forth. Grass, horrid and coarse, grew a foot high on each side, the mud slid, rounded stones rolled and bounded down if one trod carelessly, and from below came curling wisps and swirling clouds of vapor. Our path lay along a steep declivity that curved concavely like a funnel. It was as if we were descending the bell-shaped mouth of a huge blunderbuss, and at one time this curving slope had been something very similar.

At length, the bottom. On all sides were high, bare, curving slopes, blasted and withered, devoid of growing things. Carefully, we picked our way over a lozenge-shaped area of a few acres. There were sharp rocks and white and yellow, crusty, sickly-looking earth that crumbled underfoot. There were jets of steam, hissing spouts, fumaroles, and boiling springs that one might cook in. There were tiny vents in the earth's crust from which intense heat came. Everywhere water and steam hissed, spouted, and burbled.

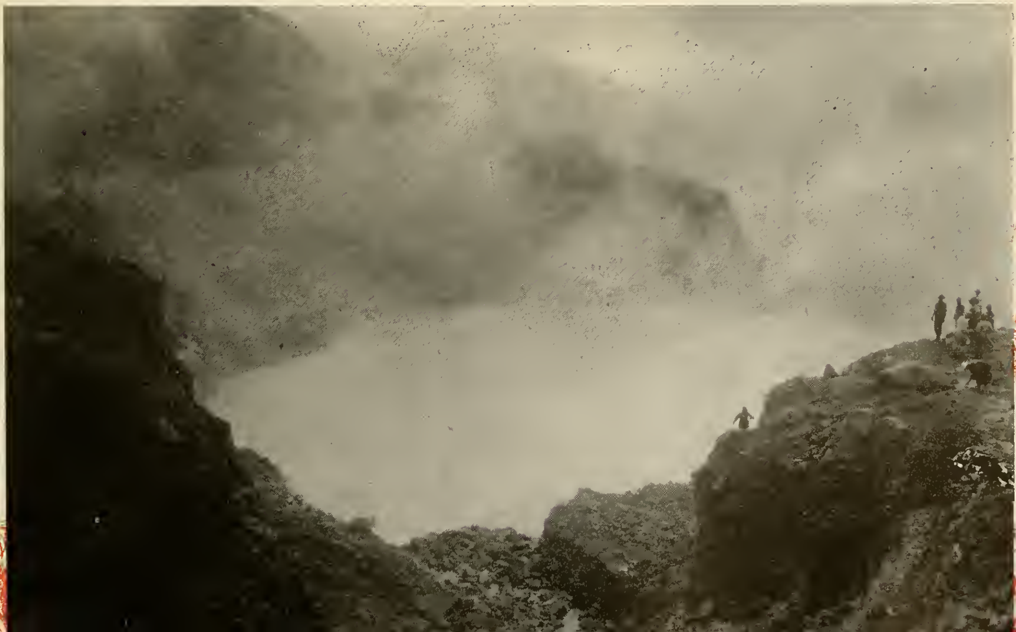
Through clouds of steam we traversed this infernal gulch on carefully chosen rocks, watching each step lest an unnoticed vent scald foot or ankle. The only outlet was by a stream discharging through a canyon, very narrow and with high unclimbable walls. Our only path lay along the bed of this stream, whose waters bubbled and steamed, actively boiling.

For a good half mile we followed this torrent, stepping and sometimes leaping from rock to slippery boulder, constantly crossing and recrossing. There were many boiling pools four feet deep to hop over, and a misstep could have meant a painful death.

At length, on our left, another boiling brook joined the waters of our stream, and up this we turned

Continued on page 476

▼ THE BOILING LAKE, where huge bubbles are known to have extinguished human life



The first nest of the Black Swift ever found in Colorado is discovered almost two miles above sea level, in the icy spray of a mountain chasm

By John A. Murphy, Jr.
Denver Museum of Notural History
Photographs by the author, courtesy of the Denver Museum of Notural History

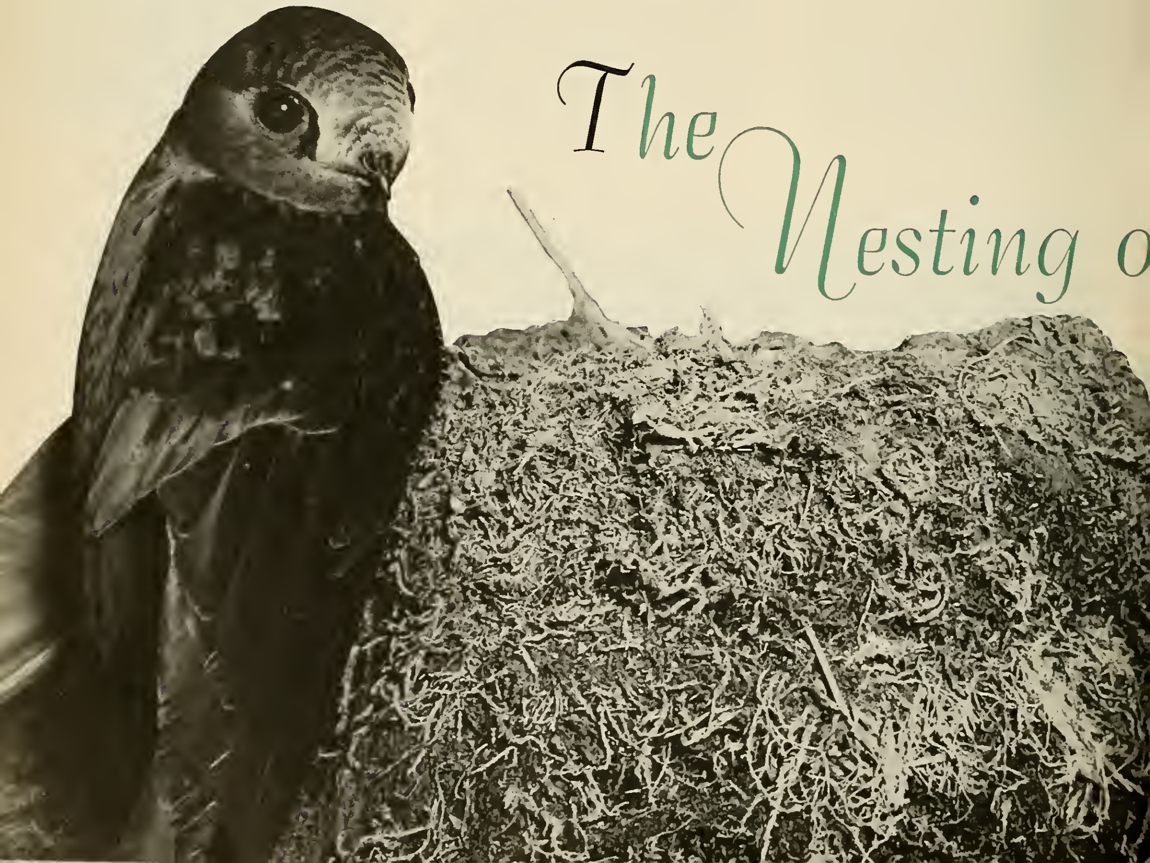
TWO years ago I was sent by the Denver Museum of Natural History to learn something of the nesting habits of the Black Swift. Considering the fact that not one nest of this bird had ever been found in Colorado, the mission was something of a challenge. In the early '80's, the bird had been reported to exist in the high mountains of the southwestern part of the state, but we had not heard much about it since then. With the late Robert Landberg, I combed the canyons and mountaintops, but our work was almost a complete failure.

Then this last season, Curator of Birds Robert J. Niedrach sent Lang Baily of the Museum staff and Al Knorr to work the country adjacent to Silverton in the high San Juans. These tireless bird students located nests on steep canyon walls in almost inaccessible locations near Howardsville and one on the South Fork of Mineral Creek. It might conceivably be possible to photograph the latter one.

I was delegated to secure pictures of these birds on their nests, and I joined Baily and Knorr on July 2 at Silverton, a mining settlement in a picturesque valley dominated by great mountains. We borrowed two twenty-foot extension ladders and headed up the valley between towering hills to a series of waterfalls. We had a job getting the ladders up the hill, for the steep slopes were covered with low brush and down timber. We were on our hands and knees much of the time as we inched the ladders upward. It took us one hour to travel 300 feet.

Finally, we wormed the ladder to

The Nesting o



▲ IN THE DOMAIN of the Black Swift: a view of Red Mountain in the San Juans

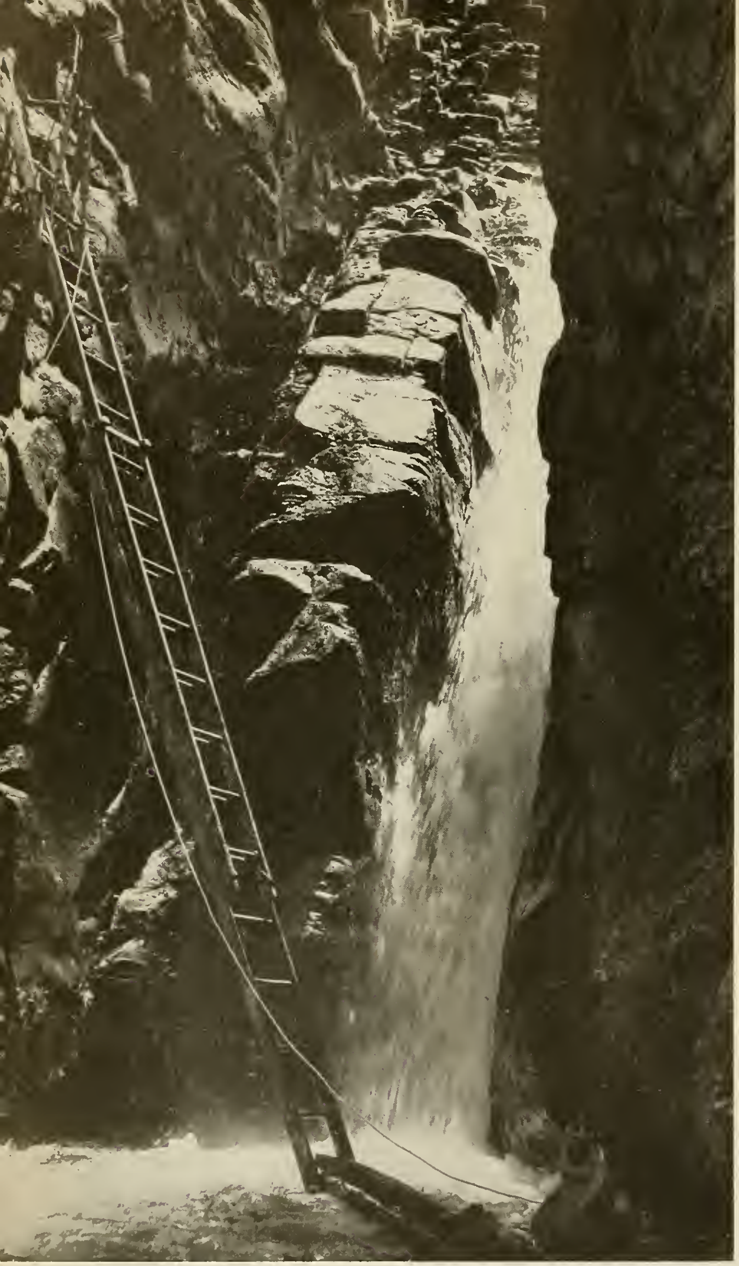
the Black Swift

the foot of the fall below the nest, and the discoverers of this first Colorado nest of the Black Swift pointed out the canopy high above.

From one place on the rocks on the upper side of the canyon, we could see the nest through our binoculars. But there was no bird upon it. The place was wild and picturesque—a narrow canyon with 4 levels of falls towering above, each with a drop of 50 feet or more. The water cascading from the snow-capped crests of the jagged San Juans was ice cold, for we were at an elevation of about 10,500 feet. The lowest waterfall was 20 feet wide at the top, and it plunged 40 or 50 feet into a pool of water about 5 feet deep, in which the current was very swift. The nest was directly above this, and the ladder had to slope across it. The canyon was so narrow that there were only fifteen minutes of sunlight each day, and no direct light at all ever entered the area where the nest was.

We had a tough time erecting the ladder. Lang Baily stood waist-deep in the ice-cold water holding the bottom, while Knorr and I slowly heaved it into place. Then the extension was raised until we had a look into the nest and saw the first egg recorded for this bird in Colorado, so far as we knew.

The nest was made of tightly-packed moss, about eight inches wide at the base and five at the top. There were several levels differing in color, indicating that the nest had been used through several years, with new material added each season. The moisture made the nest look fresh and green, almost as though the moss were growing. The cup was only about



▲ WHERE THE AUTHOR spent many hours drenched in clammy spray, taking these photographs of the Black Swift. The nest was on a ledge in a cavity with walls behind sloping up and out over the nest

three-quarters of an inch deep and was lined with dead pine needles, which were brown and brittle. The single egg always seemed to have the widest part toward the face of the cliff during my observation. The color was white, with a mottling of faint pink in a band around the egg. Considerable moisture was caused by a downdraft, and the temperature in the area was sometimes as low as 32 to 34 degrees.

We sighted birds circling, and, as we did not want to risk their leaving the area, we left the ladder against the wall and made our way to the car.

I returned alone to the nest the following day. At my first appearance, the bird quickly left the nest. So I rapidly fastened the tripod to the top of the ladder and left it so that the old swift could become acquainted with it.

When I returned on July 29 at 7:00 A.M., the incubating bird remained on her egg until I climbed halfway up the ladder. Then I put the camera in place, but it was so dark that I had difficulty focusing; then I took up my observation post at the foot of the cliff. From this position I saw the bird come and go a number of times. It was disappointing to have to leave late that afternoon without any pictures, but the light had been too poor, and I had to remove the camera each time to protect it from the weather.

The next day, I back-packed all my flash equipment, and it was quite a job. This time I set everything up for an extension flash. Working fast, I soon had everything ready to take a picture from an observation ledge. The bird fooled me. I waited an hour, thinking the nest was still empty, when suddenly the bird flew off. She returned again in five minutes, however. I pressed the button and had my first picture—the first of a Colorado nesting Black Swift, so far as I know. The bird darted from the nest at top speed and was gone. When she returned seventeen minutes later, I left her to incubate in peace.

In the ensuing days the bird got quite used to me, and once she alighted on the ledge so close I could have touched her.

I shall not tell of the many hours I waited and watched, drenched most of the time by spray carried in the downdraft. On August 17, the egg was pipped with a slight crack around the center. When I returned in midafternoon, half the shell was on the nesting ledge and the other half crushed in the bottom, and there was a tiny new Black Swift in the nest. The incubation period was approximately 24 days. The young one was a little fellow with tightly closed eyes, and the anxious parent flew about my head.

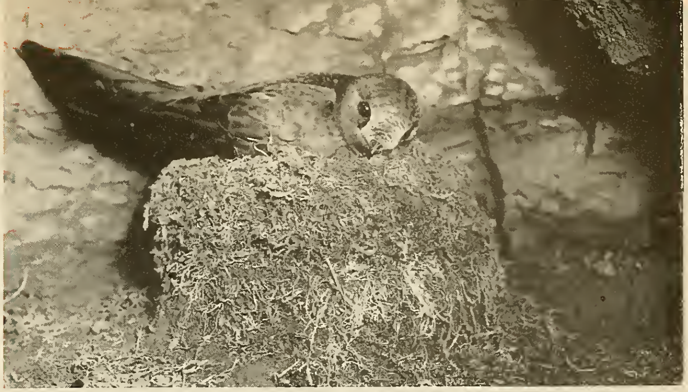
The two adults were slightly different in size, and the smaller of the two, which I took to be the female, was darker. The other was more mottled and had considerable gray on the back. When both were away from the nest, the coal-black youngster kept moving its wings spasmodically. The nest was always very clean. Occasionally both adults would be upon the nest at the same time, one giving food to the other.

By September 9, the young bird was about a third the size of its parents, and its wing feathers, though not quite developed, were edged with white. I constantly marveled at the hardihood of these high-altitude birds, nesting in the shadows on sheer rock walls that were like refrigerators during the entire season.

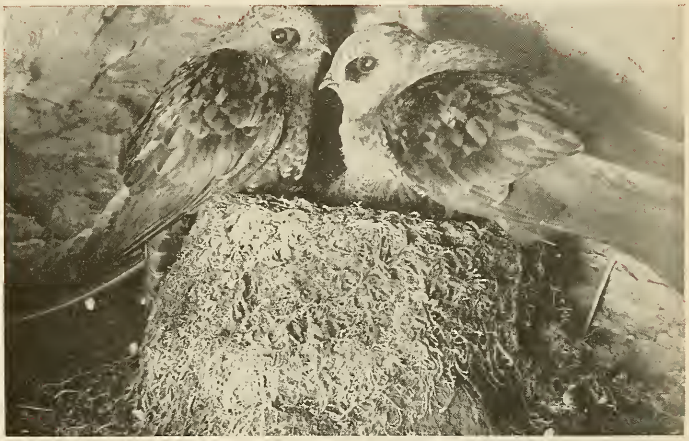
As the days passed, the adults stayed away longer, and Junior became more active. The young bird seemed to know when to expect the arrival of the parent. It would face toward the open with its neck resting upon the edge of the nest and, with flapping outstretched wings, give peculiar high-pitched notes. On September 13, the feeding was at 7:45 A.M., but although I remained until 6:45 in the evening, neither of the parents returned.

The adults had been growing wilder. They would feed the young one in a hurry and take off immediately; and there were half a dozen other birds of their kind in the air. The next day, the young one was gone, and there were no adults to be seen.

It had been a strenuous bit of bird watching, and I was content to retire to lower altitudes; but I am glad to have had the privilege of those days afield in the high San Juans of Colorado.

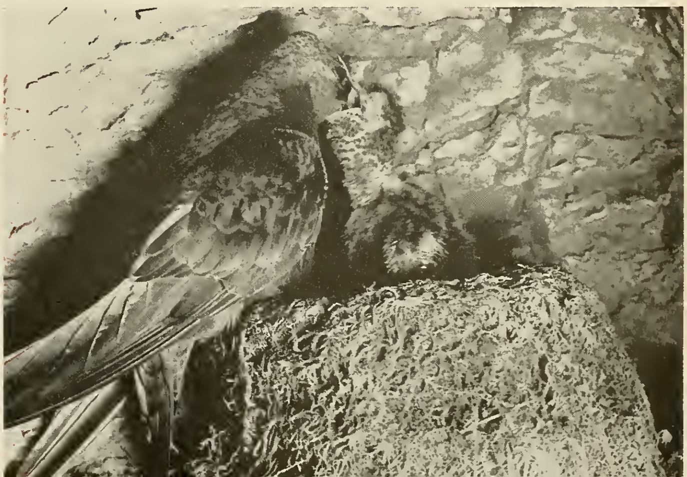


▲ THE PARENT BIRDS were suspicious of the photographer. At one point he dismantled his photographic equipment lest the egg become chilled through their absence



▲ AS TIME WENT ON, the birds showed less anxiety. Sometimes they both remained on the nest at once

▼ AFTER approximately 24 days of incubation, a coal-black youngster emerged from the egg. Twenty-nine days later all of the swifts departed



Novel sound effects distinguish a new exhibit recently opened at the American Museum of Natural History portraying the primitive life of the Peruvian rain forest

Men of the Montaña

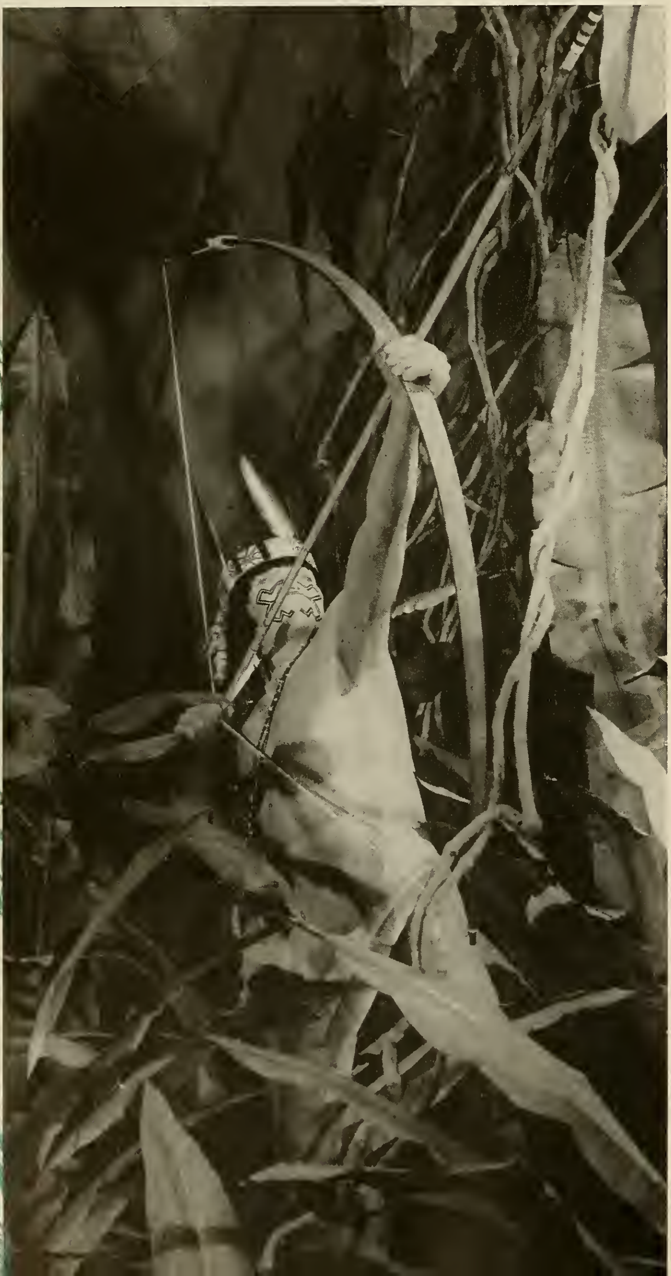
By HARRY TSCHOPIK, JR.

Assistant Curator of Ethnology
American Museum of Natural History

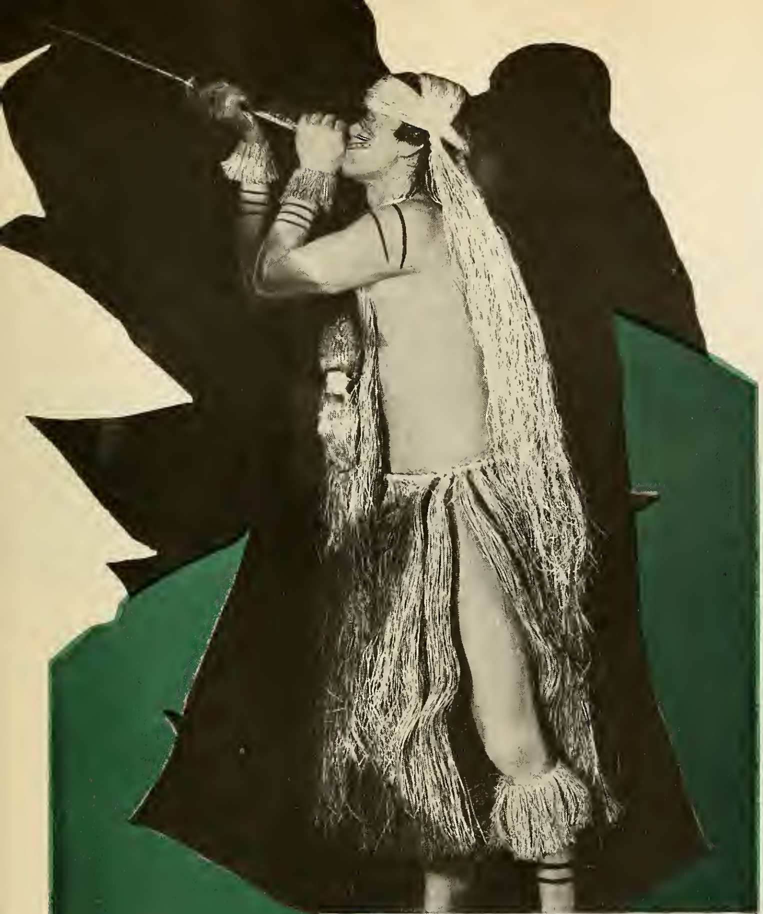
All photos by A. M. N. H.

How could a man be transported in five minutes from New York City to the heart of the rain forest of tropical South America? How could he be dropped down into the daily life of a primitive Indian settlement thousands of miles distant and centuries away in terms of cultural development? That was the problem that faced us at the American Museum in assembling for public display one of the most remarkable collections of native articles ever brought out of the little-known corner of the Amazonian headwaters known as the Montaña.

To show the material in its proper setting we had to build a rain forest and record the sounds that the forest makes. The result is startling. A museum visitor who a moment before was a part of the wintry turmoil of metropolitan traffic suddenly steps into the soft green light of the tropical forest and hears the bark of howler monkeys and the cries of parrots, macaws, toucans, and bell birds against a background of torrential rain.

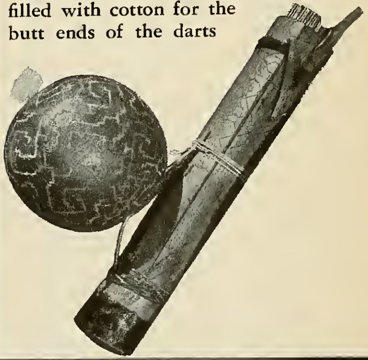


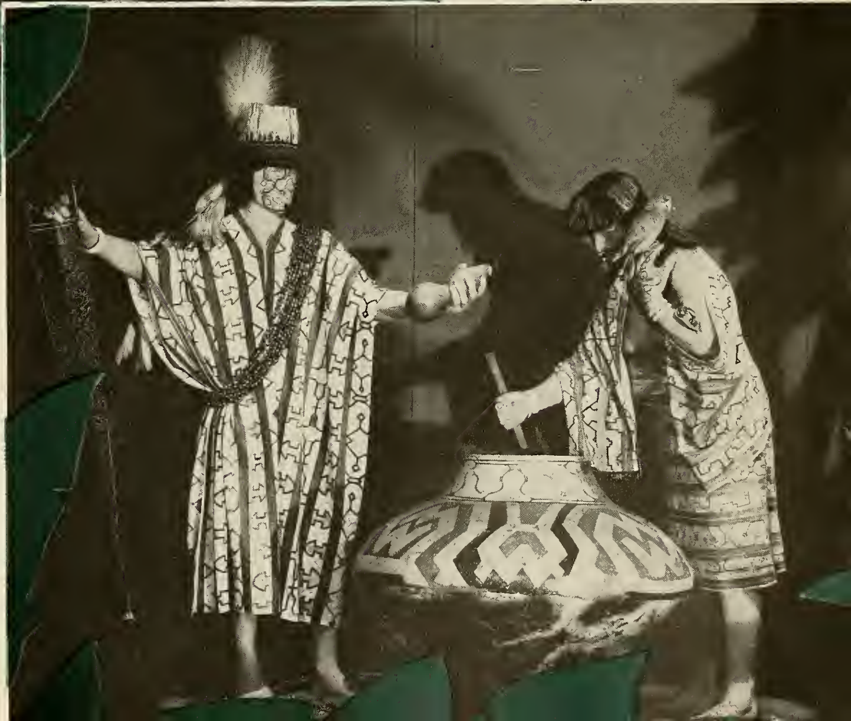
◄ A WARRIOR of the Cashibo tribe embarking on a head-hunting expedition. Long shots across a village clearing are executed by pointing the arrow high as shown here. The warrior would not poison the arrow except for use against animals. The Indians believe that curare would lose its effects if used against man. But the warrior will spend more time decorating this arrow than he would any implement not used in warfare



◄ EIGHT- OR NINE-FOOT BLOWGUNS are among the principal hunting weapons of the Montaña tribes today. The Yagua hunter shown here carries a well-filled dart case around his neck. The darts will be poisoned with curare, the manufacture of which has long been a monopoly among a few tribes, who traded it widely throughout the region. The container for the curare, concealed behind the dart case, is—of all things—an aspirin bottle. This is one of the few evidences of civilized influence to be found among this remote tribe today

▼ ANOTHER TYPE of dart case, used by the tribes of the Ucayali River region. The darts are made of the midribs of palm leaves. The gourd container is filled with cotton for the butt ends of the darts

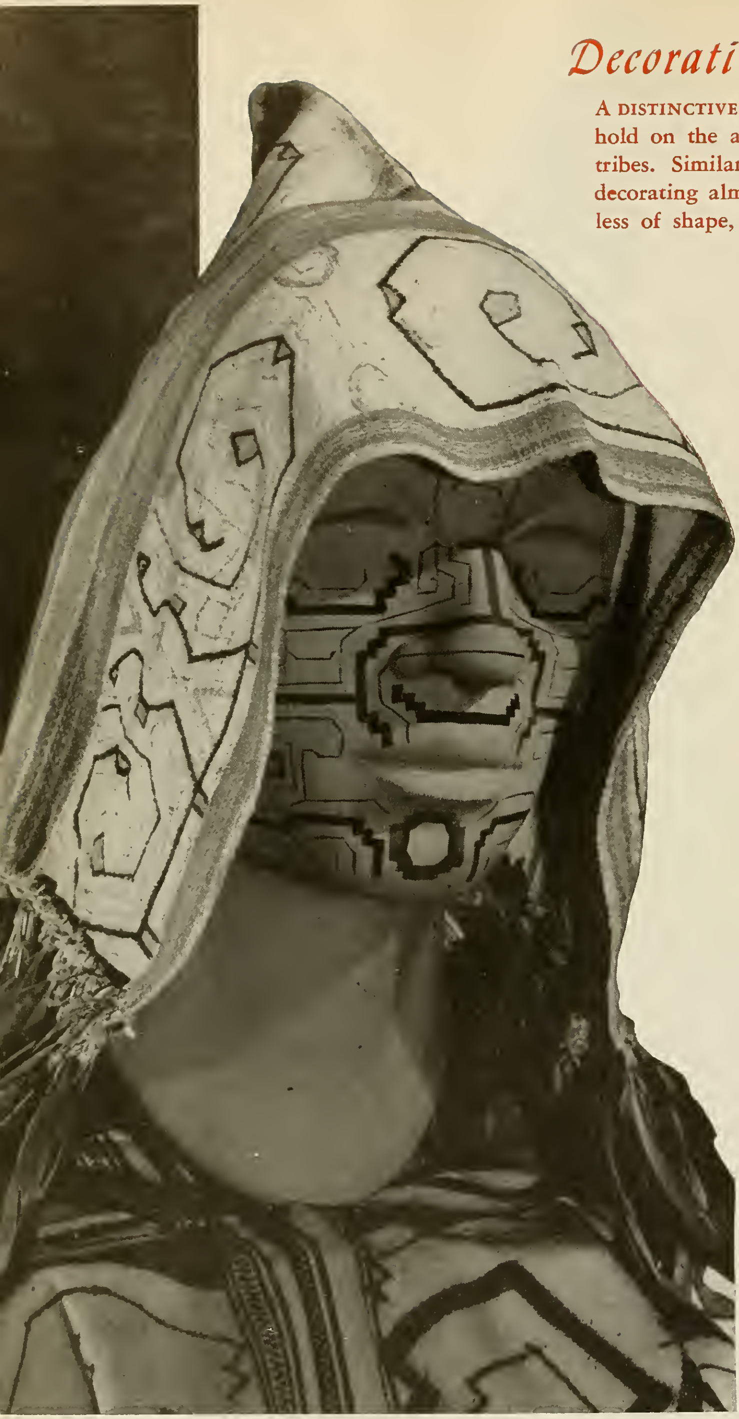




► BEER DRINKING BOUTS were held to honor adolescent girls, to celebrate successful war parties, and on numerous other occasions. The beer was made from corn, manioc, or sweet potatoes, chewed and fermented, and finally strained through a basketry sieve. The man thirstily extends a gourd cup, while the woman serves. Pet parrots, monkeys, and other animals were kept in great numbers by the tribes of the Montaña

Decorative Style

A DISTINCTIVE decorative style has taken a strong hold on the artistic expression of the Montaña tribes. Similar or identical designs are used for decorating almost everything they make regardless of shape, texture, or material

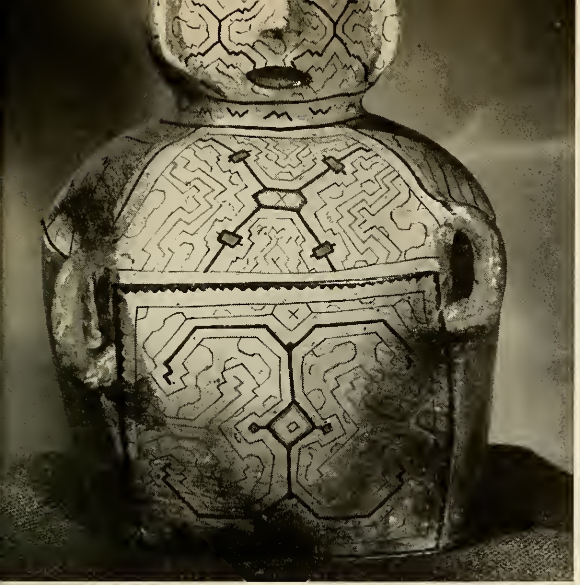


▲ BEFORE THE WHITE MAN came, the Montaña people wore no clothing except for ornaments or during ceremonies. Concepts of modesty were introduced by Catholic missionaries, who may have suggested the idea of the hood

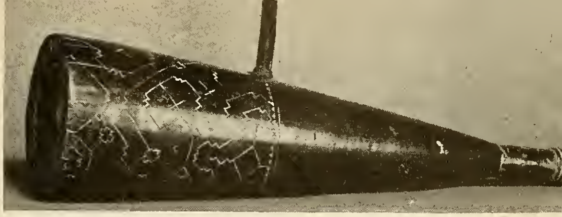
The tribes depicted in the exhibit occupy an inaccessible region of eastern Peru—a land of forest-covered mountains and rapid streams that stretches eastward from the foot of the Andean chain. Even though the area seems impossibly remote from the modern world, it has touched upon the lives of all of us. Quinine and cocaine are products native to the Montaña, and barbasco, now commercially important in the manufacture of insecticides, was first discovered by the Indians of the upper Amazon as a drug used to catch fish. During the last war, when the Malayan supply of rubber was cut off by Japanese conquest, Montaña sources were a vital factor in the Allied war effort. It was rubber, in fact, that led originally to the acquisition of the Museum's Montaña collection, for it was assembled over a period of 25 years by Raúl de los Ríos, a Peruvian planter.

The late Francis Adams Truslow met de los Ríos and saw these treasures when he was in charge of the U. S. Government project for finding new sources of rubber during the war. De los Ríos was obviously a careful and scholarly collector. He had taken pains to store the specimens in beautifully made boxes, many of them of tropical mahogany. Truslow at once sought a means of purchasing the collection for science. He graciously arranged for a foundation to buy it, and thus it became the property of the American Museum.

The first white men to enter the Montaña were the sixteenth-century Spanish conquistadors, who made brief explorations of the Amazon headwaters in search of gold. Few colonists followed their



▲ AN EFFIGY pot bearing the same type of geometric designs that were used in painting the face



▲ SOME TOBACCO PIPES, carved of wood and decorated with engraved designs, weigh as much as three pounds

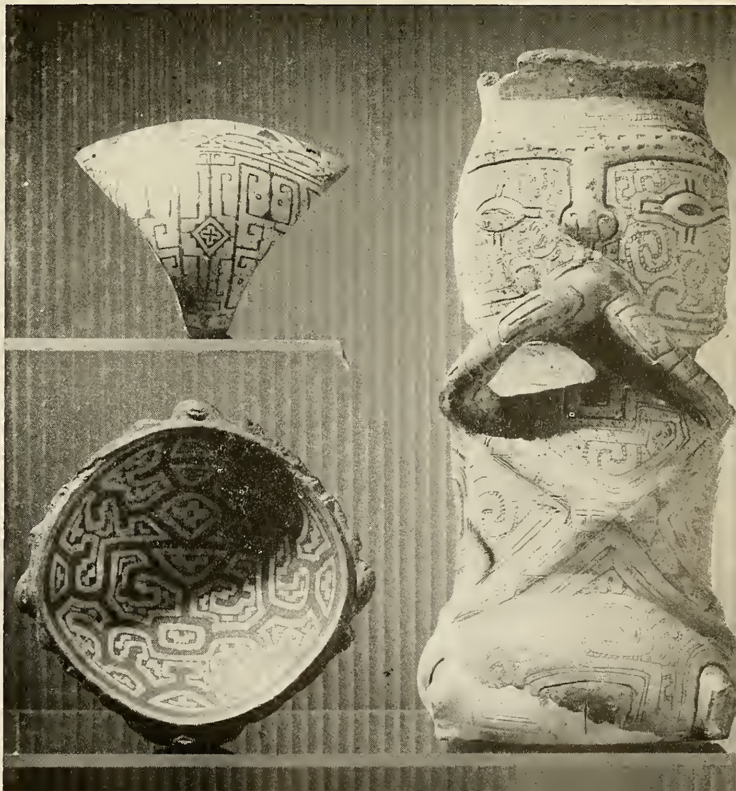
▲ A DECORATED WAR CLUB

➤ A SIMILAR ART STYLE, though drawn in smaller scale, was used to embellish this lip ornament. This ornament hung from the lower lip, in a perforation made to receive the skewer at one end

wake. Except for the sporadic activities of missionaries, the inhospitable Montaña was largely ignored by the civilized world until the above-mentioned plant resources, especially rubber, attracted the white man in numbers at the turn of the century. Even so, the region has received little attention from scientists and is almost unknown to the public. In fact, until the present effort, no museum in the United States has ever before featured material from the vast rain forest of the Amazon Basin.

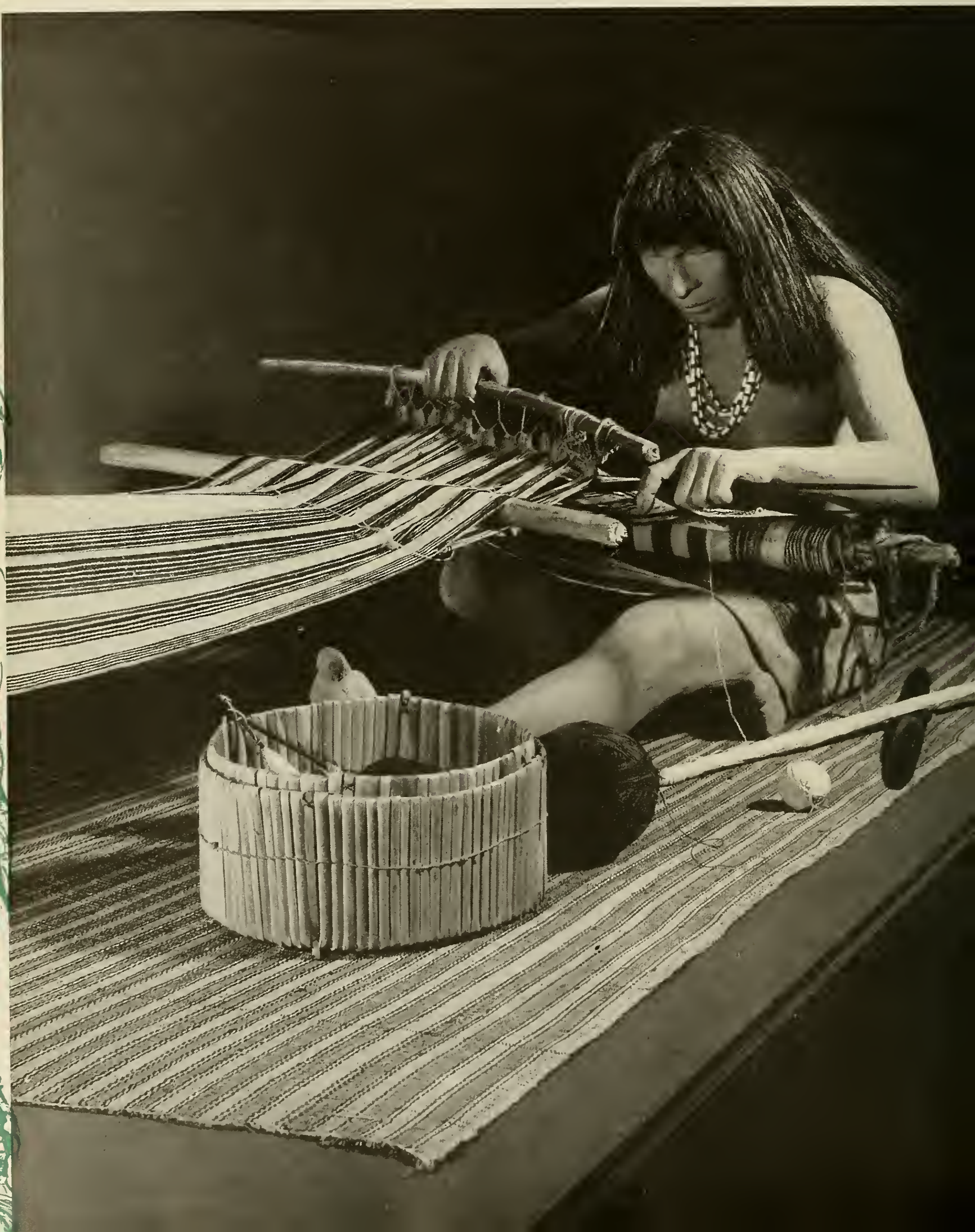
The Montaña tribes are noteworthy in other respects. Although their homeland lies in the very foothills of the Andes, they have been little influenced by the highly civilized peoples of highland Peru. Instead, because the rivers of the Amazon system have long served as routes of trade and communication, the Indians of the Montaña share much in common with tribes living thousands of miles away downstream to the east. Yet in spite of these contacts, the tribes of the Amazon headwaters have until recently remained primitive and backward even by Amazonian standards.

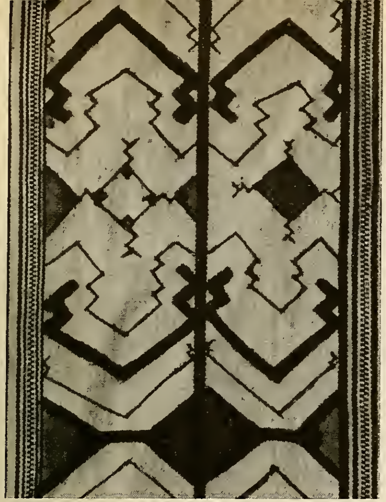
▼ A SIMILAR DECORATIVE style found 2000 miles away: objects fashioned by the ancient peoples of Marajó in the Amazon delta. Although it is not known where this style originated, the resemblance is too striking to be coincidental. The pottery excavated on this island includes effigy jars, bowls, and pottery *tangas,* or fig leaves, worn by the women (*upper left*)



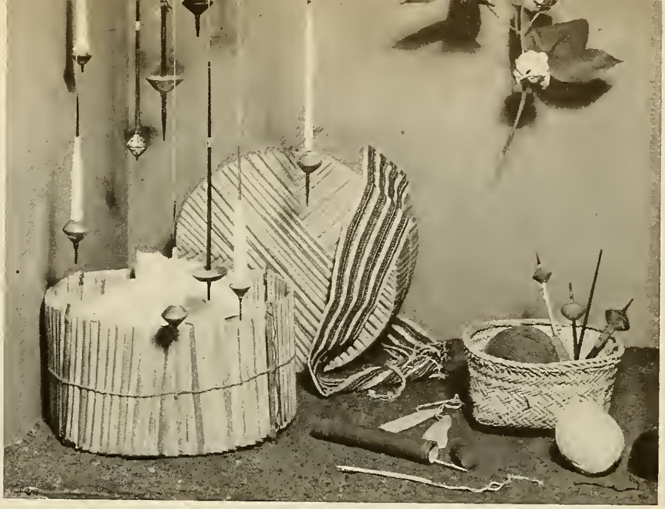
Weaving

▾ THE USE of the horizontal belt loom is one of the few elements of culture the Montaña people share with the Incas and their predecessors. The tribes of the rain forest used looms of this type for weaving shirts, as well as skirts and shawls for the women





▲ **Typical** of their textiles, this example of cotton cloth bears the traditional geometric decorations, which are painted on after the cloth is woven. The parallel stripes, however, were woven in

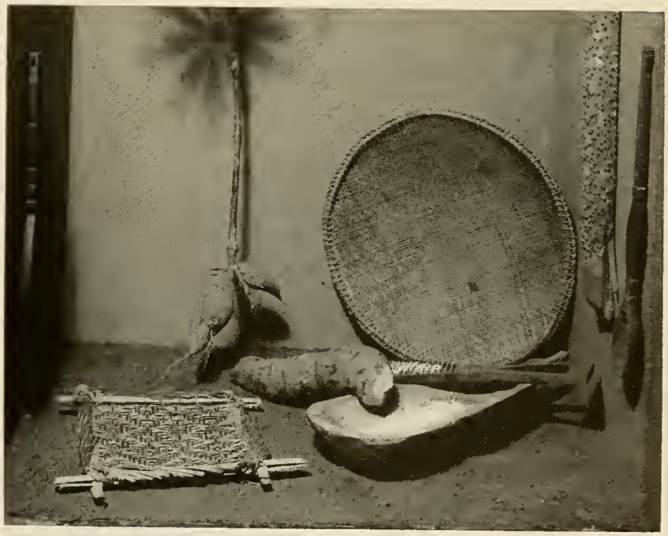


▲ **Cotton** of both the white and brown varieties is grown by most of the tribes of the Montaña, except for the Campa and Piro, who gather it wild. The fibers are carefully cleaned by hand and are then spun into thread on a drop spindle like the ones shown here—another type of implement that may show influence from the Andean highland

In their heyday, the Montaña peoples were extremely warlike, taking and shrinking the heads of their slain enemies. They lived in small, mutually hostile families scattered over an area equal to that of Arizona and New Mexico combined. The total population of the Montaña, however, probably never exceeded that of Syracuse, New York. Here, in constant fear of ambush by neighboring groups, the members of each household slashed their fields out of the luxuriant jungle and hunted and fished along the rivers, moving on to new territory whenever the thin tropical soil and the game supply became exhausted.

At present, head-hunting has almost disappeared and warfare is on the wane as the white man's civilization penetrates more deeply into the Amazon headwaters. Paradoxically, it is possible to see more of traditional Montaña life today in New York City than in the rain forest of eastern Peru.

▼ **Manioc,** the most important of the tropical root crops, has been called the staff of life of the Amazonian lowlands. The tubers of the sweet variety are shown here, together with graters, strainers, and other implements used in the preparation of this food. The poisonous manioc, which is processed for food widely elsewhere in the tropical forest and is our source of tapioca, is not grown in the Montaña



Thus with relatively few personal possessions and a technology exceedingly simple by our standards, the tribes of the Montaña have nevertheless adapted themselves well to the conditions imposed by their tropical environment

▲ A SIGHT VISITORS to Africa always remember—the mighty baobab surrounded by lush vegetation

The Tree that Time Forgot

A candidate for nomination as one of the Seven Wonders of natural history is the monstrous baobab, mystery tree of Africa

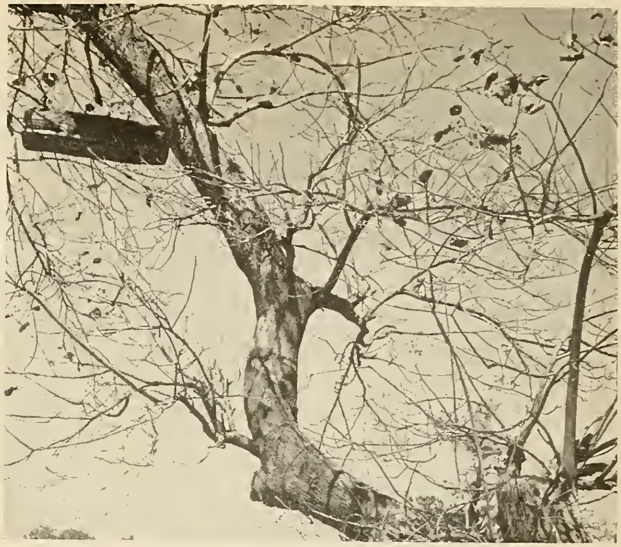
By RUSSELL BARNETT AITKEN

Photographs by the author

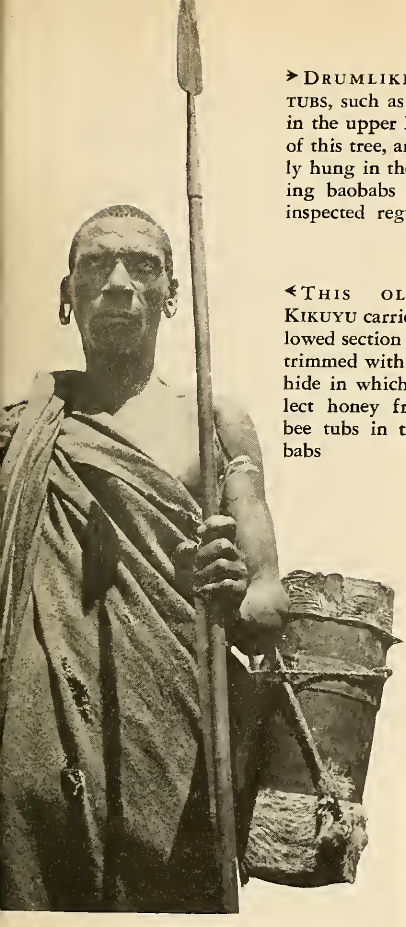
FOR 6000 years of recorded history Africa's savage songs have been chanted to the pounding of primitive drums. Since we call this skull-shaped continent the traditional home of Mumbo Jumbo and mystery, perhaps it is fitting that one of its trees should remain something of an enigma. It is the giant of jungle and veldt known as the baobab (pronounced BAY-o-bab).

Botanists argue as to the age it attains. Settlers declare it to be so ancient that no young trees of the species have ever been seen. A pioneer big-game hunter, William Cotton Oswell, agreed with this and claimed moreover that the smallest he had encountered measured 45 feet in circumference. There are others who solemnly believe that venerable baobabs standing on the coast in all probability once looked aloofly at Roman and Athenian galleys, and that the royal barge of Cleopatra herself may have saluted them when she sailed southward to view the land that had supplied her with gold, ivory, leopards, and slaves. This romantic notion is scoffed at by modern scientists, who point out that records exist of the tree commencing to fruit at eight to ten years and that a specimen planted in India was as big at 300 years as one that was claimed to be 5000 years old by its discoverer. But no one can dispute that this gigantic and repulsive tree has intrigued virtually every visitor to the parts of Africa where it grows.

It is known by many names, among them Monkey-Bread, Calabash, Ethiopian Sour-Gourd, and Cream-of-Tartar Tree. The Swahili call it *mbuyu,* while in certain sections of South Africa it bears the name *moana* and in more northern section *kuka* and *tebeldi.* Witch doctors in East Africa have their own designation for it—*mkuu hapingwa.* It is generally considered a member of the silk-cotton family (Bombacaceae), and its technical

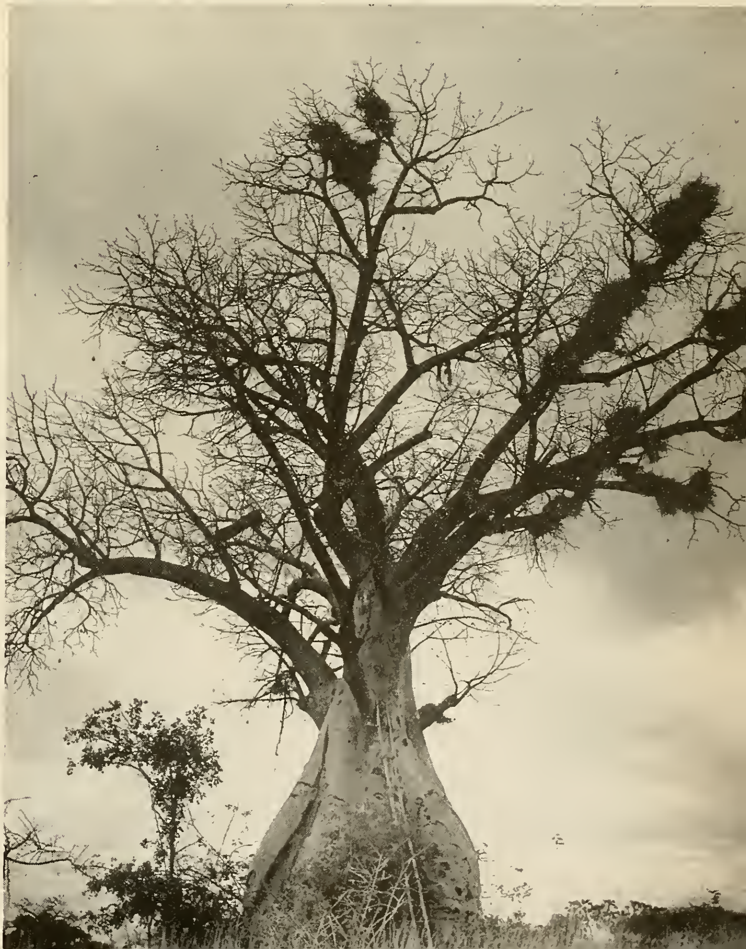


➤ DRUMLIKE BEE TUBS, such as the one in the upper left part of this tree, are usually hung in the towering baobabs and are inspected regularly

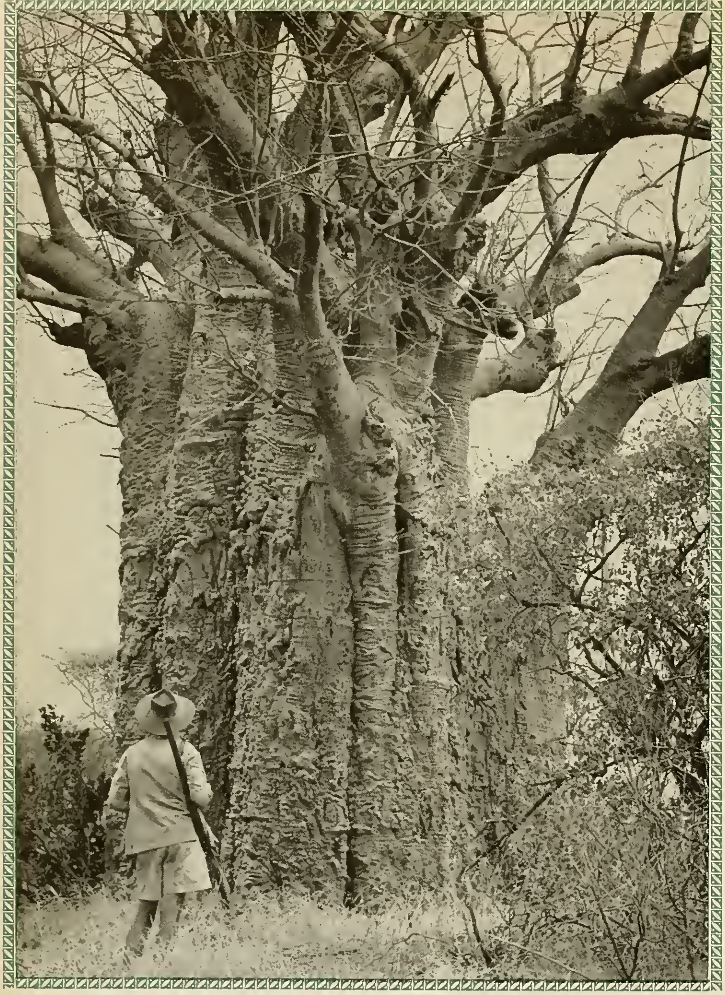


◄ THIS OLD-TYPE KIKUYU carries a hollowed section of a log trimmed with baboon hide in which to collect honey from his bee tubs in the baobabs

▼ THE BOTTLE BAOBAB is peculiar to certain sections of Africa. The ladder leaning against this one leads to the loglike native beehive seen among the lower branches on the left. Above are nests of the gregarious weaverbird



▼ THE AUTHOR'S baobab-inspecting scout car stops near a bottle baobab. The bark of this one had the exact texture and color of elephant hide



▲ "CREAM-OF-TARTAR" TREES, as the baobabs are called because parts of them are used in flavoring food, grow to tremendous size on Zanzibar. This one is 72 feet around. Many have hollows inside their trunks, and on the mainland some tribes make use of the water accumulating there. Others place their dead in them

name, *Adansonia digitata,* came from the celebrated French explorer, Adanson, who roamed Senegal about 1750.

The baobab usually grows to only a moderate height, but it has a ponderous girth out of all proportion, so that it resembles a monster toadstool with a tiny cap when in leaf. When naked, its gnarled branches with pendulous fruit are reminiscent of the tortured souls transformed into trees in Doré's illustrations for Dante's *Inferno.* There is a leprous look about its dirty-pink, glabrous bark and massive trunk, swollen like the limbs of a victim of elephantiasis. The digitate leaves, similar to those of the horse chestnut, remain on the tree approximately five months.

Big trees are probably impressive because of their ability to make man feel his own relative unimportance. The redwoods of California, towering majestically into the heavens, are genial giants, and with the soft light filtering down between their aisles they invariably remind people of a holy cathedral.

Not so the baobab.

It stands stark and defiant, almost menacing with its brooding bulk; and to those of us familiar with northern woodlands, an intangible aura of unnaturalness hovers over the somber monster.

Its unusual appearance undoubtedly accounts for the widespread native superstition that the tree is inhabited by evil spirits—a belief that may explain the witch doctor's name for it. No tribesman has ever been able to explain satisfactorily the meaning of *mkuu hapingwa* to me, and in consequence I have had to play detective in an attempt to solve its derivation. The prefix *mkuu* is Kiswahili for "big" or "pre-eminent," while *pingwa* is the passive form of the verb *pinga,* which means "to block or thwart." By their appellation the juju men may thus signify that the powerful demons dwelling within the baobabs counteract their own medicine-making —a handy alibi when their wizardry miscarries. More learned students of Kiswahili than I may be able to shed light on some other obscure or esoteric meaning.

Regardless of its exact meaning, however, the fact remains that many a simple African regards the baobab with such dread that he will avoid passing near one when dusk creeps across the veldt. The Wakamba used to propitiate the great tree with offerings, much as ancient Egyptians honored the Sacred Sycamore, *nûhît rîsit,* which they worshipped as a symbol of Hâthor.

The soft, spongy wood of the baobab has no resistance to a modern bullet, and a 30-06 solid will completely penetrate the largest of them. Travelers who noted this wrote the tree off as a bizarre but useless tree, yet for all its malignant appearance there are few growths in nature as bountiful.

During the rainy season its knotted hollows preserve water, which can be found weeks and even months after the dry weather has set in. In some sections of Western Kordofan this forms the native's chief source of the precious fluid. Pith hacked out from beneath the tough bark can be wrung out like a dishcloth to yield moisture, much like the barrel cactus of our own Southwest, and it has saved more than one trekker of the parched *nyika* wastes when his canteen went dry.

The flower, a waxy bloom that tarnishes rapidly, is sometimes crushed with sugar and water to make a refreshing and unusual beverage, and the seeds yield a valuable oil. The rind of the pods can be chopped and mixed with milk or water to make a bitter-tasting although nourishing biscuit. The subacid farinaceous pulp surrounding the pips is crushed and ground into a powder used for flavoring food, hence the name "Cream-of-Tartar Tree." Mixed with water, this substance forms a lemonade-like liquid esteemed by some as a febrifuge in combating malaria.

Along the coast near Mombasa the Giriama women, in preparing their elaborate coiffeurs, first soak their hair in a baobab-seed solution, followed by a lime-juice rinse.

The fibrous bark of this remarkable tree furnishes material for cloth and rope, and in the days of muzzle-loading guns the hunters cut off squares of bark to obtain the inner fiber for use as wadding. Experienced sportsmen on safari usually head for the scant but welcome shade of the baobab when ready to set up their base camp. When Kermit Roosevelt journeyed to the Shimba Hills of Kenya in quest of sable antelope, he camped by choice under such a tree, but not for long. His boys had inadvertently pitched the tents over a subterranean ant kingdom.

The bark of the baobab has the texture of cast cement and is a sooty gray with pink or purplish overtones. Since this is exactly the color of an elephant, many a veteran of the Ivory Trail has swung a rifle at one when emerging suddenly from dense bush. William Oswell himself sheepishly admitted having done so. Sometimes multiple trunks weld themselves together to create a massive fortress-like bole, and in certain sections the trunk simulates the general shape of a beer bottle. In Rhodesia and on Kenya's northern frontier there are many such bottle baobabs.

Sir Richard Burton, trained observer that he was, noticed 90 years ago that these big trees were not all alike. He was the first writer who alluded to the baobab as *mbuyu* ("bucket"), which derives from the Swahili custom of making water buckets from the seed pods by cutting slits in the upper section of the acorn-shaped pod and lowering it down into the well with a cord of plaited palm leaf. Along the coast these baobab buckets used to be seen frequently hanging outside the huts. The seed vessels hang perpendicularly from the branches on stringlike stalks and for a time are covered with thin gray plush.

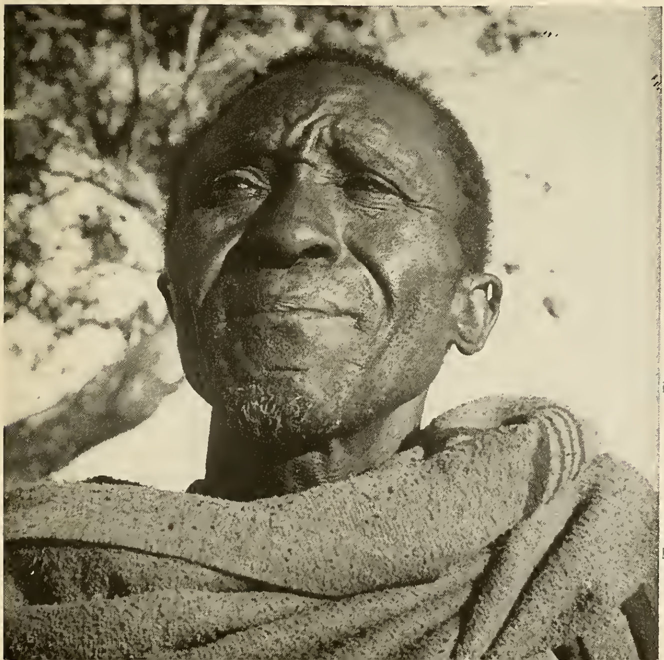
Most hollow trees become dead or rotten inside after a while. It was David Livingstone, a keen naturalist as well as missionary, who discovered that baobabs were different in this respect. In his journal *Expedition to the Zambesi,* he declared that a hollow baobab, though stripped of its bark outside, had the power to grow new bark on both inner and outer surfaces.

The giant trees fascinated this gentle man, and he came across what must have been one of the largest of them while in Makolo country. His original letter, which was written to his brother Charles in 1853, is preserved in the Scottish National Memorial at Blantyre. Here is what it says:

"I am standing under a Moana or Baobab tree composed of six branches rising from one root and joined together until about five feet from the ground. At three feet from the ground it is 85 feet in circumference and is at least 60 feet high. The reddish color makes it look more like a mass of red granite than a tree. The branches high above look like what I have hitherto called large trees. The wood is quite soft and spongy."

It is under a giant baobab in lonely Shuhanga, on the banks of his beloved Zambesi, that Livingstone's devoted wife, Mary, lies buried.

Baobabs have always been fa-



◀ THE WAKAMBA were formerly cannibals, yet you couldn't bribe this oldster to go near a baobab after dark. He's squeamish about spooks vored by the less superstitious tribes as racks on which to suspend their drumlike bee tubs, and they drive pegs into the pulpy wood of the trunk in order to reach the higher branches. It isn't solely a sweet tooth that occasions such industry, however. From chunks of fermented comb the natives make a sort of mead, on which they get as intoxicated as they did from the square-face bottles of gin once peddled by unscrupulous traders.

What is probably the cleverest description of the big tree without foliage was penned at the turn of the century by a hunter named Ansorge. "With its aldermanic girth," he wrote, "when it has shed its leaves it stands bare and gaunt and looks as if stretching out gouty fingers in apoplectic uncertainty."

The grotesque tree has always interested scribblers, and in Mombasa they tell the story of how it was once misnamed by a lady journalist visiting briefly from a cruise ship. Being interested in plant life, she hired a native boy to guide her about. Unfortunately he was a *shenzi,* an upcountry boy to whom all such things were blanketed as *miti*—just 'ol trees. The lady had learned only a single word of Kiswahili, *jina,* which means "name," and hoped naively that this would suffice in identifying various trees. In her peregrinations with her not-too-bright escort she happened upon a baobab and was entranced by its formidable size. Pointing to it she asked *"Jina?"* to which the native, looking blank, laconically replied *"Sijui"* (I do not know). When the glowing description of her exploits was published, it said: "The most interesting natural wonder on the island of Mombasa is a huge tree which is tall and thick, the trunk being almost as wide as a small house. It is called a *Sijui* tree."

The showers of light rain that usually fall in November cause the varied flora to burst into leaf and bloom as if by magic, and it is then that the grim baobab bedecks itself in frivolous finery. There seems to be some variation in the color of the flowers. I have seen white flowers with yellow centers, and R. C. F. Maugham reports the same coloration in his book *Portuguese East Africa.* However, Dr. Peter Bally, a botanist at the Coryndon Museum at Nairobi, informs us that in all the parts of East Africa where he has seen the tree in bloom, the color is white, turning slightly ivory-yellow and then brown as the flower fades. He also speaks of a pale mauve flower that is said to occur in West Africa, but I know nothing of this. The flowers measure as much as six inches and have massive staminal columns. With its bloated trunk and gnarled arms, the tree somehow achieves the general effect of a fat and aged actress, disguised with hair ribbon and pigtails, attempting to play a teen-age schoolgirl.

It wouldn't be fair to ridicule the fabulous tree without mentioning that it has also had its share of deeds of derring-do. On Zanzibar and its sister island, Pemba, the baobab grows to tremendous size. Pemba, a remote island where tribal witch doctors once learned their grisly trade, was reputedly selected by the swaggering Captain Kidd as a repository for his loot. For markers it was natural that he would choose baobabs because of their longevity. Within the memory of living man old natives have told tales they heard from their fathers, stories of long boats rowed to shore in the black of night. The European visitors proceeded by torchlight to a giant baobab deep in the jungle, on which a cross had been cut long before. Digging at the foot of the tree the stealthy searchers unearthed a heavy brass-bound chest full of treasures.

Another version says it was a huge silver bowl or covered dish heaped with coins, which from the description might have been doubloons or ducatoons. Burton corroborated the story when he wrote of Pemba.

"In A.D. 1698," he stated, "Captain Kidd here buried his blood-stained hoard of gold and jewels, the plunder of India and the further Orient. The people have found pots of nuggets."

It is not strange that young baobabs should be considered a mystery in some sections. Young trees are so few and far between that the Mombasa Rowing Club used to visit a spot across the creek from Peleleza for the express purpose of viewing one. They reported that in several decades the tree, a sapling, never seemed to grow an inch or alter in any way.

My good friend Commander David Blunt, whose book *Elephant* is still standard reading for tusker-trackers, told me that in his long years in the bush he had seen only five small baobabs, despite a lengthy period spent roaming the Matandu River Valley where the big trees were extremely numerous.

I had crossed Africa on safari twice before I ever saw a small one, and then I got into a patch of bush where baobabs grew in profusion. I had been on the bleak Barotse Cattle Cordon in Northern Rhodesia, and to save wear-and-tear on the axles of my safari cars I loaded them aboard a flatcar on the Zambesi Sawmill Railway to get them out of the wilderness. Rattling through the woods, accompanied by a cargo of Rhodesian teak and a motley collection of Thongas, Barotses, and Mashukulumbwi boys, I suddenly began seeing baobabs of all sizes around us, including trees as small as ten and even eight inches in diameter. It is the only place in Africa where I have ever seen any, and I suppose I should have signaled the engineer to halt while I leaped off and had a documentary photograph taken of myself triumphantly clutching one of the midget trees. I didn't, though. All I wanted was to get out of that tsetse-ridden Barotse country as fast as possible.

Many settlers, remote from botanical libraries, tried to solve the mystery of the absence of young baobabs, and 40 years ago one of them thought he had done so. He was Mr. J. E. Hughes, a Cambridge scholar turned big-game hunter, and his adventure happened on the Muchinga Escarpment in Northern Rhodesia. In that section the local name for baobab is *mlambi;* and one day while out with a native tracker, Hughes tripped over a thick creeper lying across the path. His ebony-hued companion prodded the thing with his spear and said "*Mlambi ulya,*" which means "a baobab." Startled, the hunter questioned him and was told that among this particular tribe it was common knowledge, handed down from generation to generation, that baobabs started life as such a creeper.

Being intensely interested in the old legend, he examined the repulsive-looking vine, which was about fifteen feet in length and growing along the ground. The native pointed out that it was making its way toward an adjacent large tree. The creeper was round, without branch or leaf and covered with the same purplish-gray bark as big baobabs. According to his African informant, the creeper would slowly coil like a python around the big tree. It would then gradually engulf and absorb it and expand outward like some obese glutton. Today we know that he was wrong.

There are one or two odd things about the baobab that I have noticed. For instance, I've seen good-sized ones half-uprooted and pushed over to a 45-degree angle but still growing merrily despite the new slant. On the Great North Road in Rhodesia, not far above Beitbridge, one suddenly encounters "melted" baobabs. These big trees have crumpled to the ground like a stocking betrayed by a faulty garter. Whether this eventually happens to all old ones, I am not prepared to say. I suspect instead that this is the work of a fungus that is believed to attack the species, reducing the supporting fibers to a pulpy pith without strength. It is a shocking thing to realize that the sodden heaps of squashed papier-mâche were once colossal, rocklike baobabs.

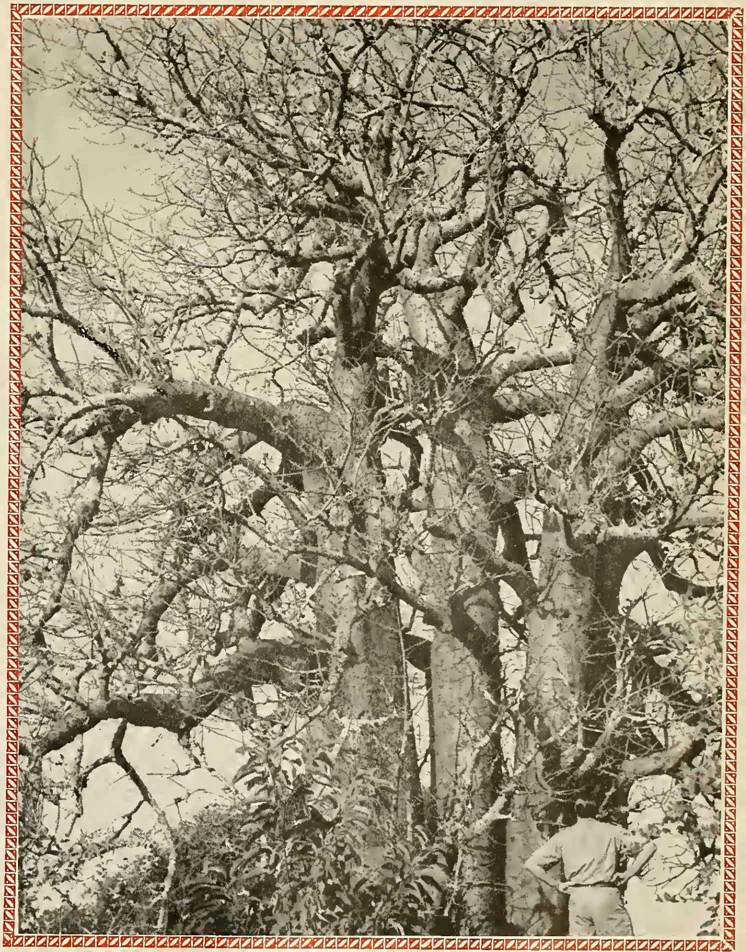
On the west coast of Africa, these great trees are found as far south as Southern Angola and as far north as Senegal, but there are no baobabs in the intervening Congo region. Near the Gold Coast the natives once used the hollow trunks as grave vaults, hanging their dead inside them. In contrast to its sinister reputation in many of the Bantu-speaking areas, the tree is venerated in the Blue Nile Province of the Sudan (where it is called *tebeldi*). Each baobab has an individual title, which is always respectfully prefixed with *um,* which means "mother."

The most northern member of this mighty tree is reputed to grow in the Palace gardens at Khartoum, where it was planted by the explorer Schweinfurth. This fact alone should have indicated the existence of young trees, since it is unlikely that anyone would have undertaken to transplant a very large specimen. This is near the northernmost range of the tree.

Today Africa is fast becoming civilized, and even back-country tribesmen are donning the clothes of the white man to learn the trade of butcher, baker, or candlestick maker. The stabbing assegai and oxhide shield of the fierce Zulu gathers dust along with the painted buffalo-hide shield and lion spear of the arrogant Masai. Ice cream soda emporiums are appearing now, and skyscrapers rise ever higher in the swank city of Johannesburg, while familiar Fords, Chevvies, and Jeeps whizz by on smooth-surfaced roads.

The old order changeth, unfortunately, but the inscrutable baobab pays no heed. Ignoring the passing centuries, it just goes on and on and on as if determined to prove that it holds the secret sought by Ponce de Leon.

⮟ **Multiple trunks** often grow from a single stem, and the resulting tangle looks like a Chinese puzzle



▲ A SNOW TURN ON TEMPO DOME. A skier is in his element on the snowy slopes of the Badger Pass Ski Area in Yosemite National Park

WINTER

throug

True nature lovers find in winter
a fresh challenge for their
outdoor activities

By JOSEF MUENCH

◄ WINTER PAGEANT. Beautiful as they are in summer, the splendid forests of Sequoia National Park take on a breathless grandeur when snow weighs down the branches with white. Rolling drifts hem in the seedlings in the meadows, making tiny mannikins of them

► MT. SUPERIOR, at Alta, Utah. Like a holiday greeting card come to life, the wintry landscape combines white mountain slopes, trees bedecked with powder-puff decorations, and snow-covered ski huts

he Camera's Eye

➤ YOSEMITE'S HALF DOME. Framed by sleet-covered branches, the famous landmark seems hardly touched by the winter force that grips the valley below

Do You Want Hunting in National Parks?

Most people did not know that a Congressional Bill was passed in 1950 breaking the inviolable rule against hunting in National Parks. Will this great departure from our national tradition be repeated in other areas?

ONE day many years ago, in the newly established Mt. McKinley National Park, my brother and I had climbed to the crest of the Alaska Range. All about us to the far horizon extended a wilderness of mountains. It was wild country. We had left the forest edge far below us. We looked out on open slopes, ridge upon ridge, as far as we could see: barren shaly slides, green slopes and terraces, cliffs and rugged peaks, in delightful disarray.

It was one of those days we like to remember—not for any astounding adventure, escape from a charging bear, or other disaster. In fact, I do not remember any special urgency. It was an accumulation of satisfactions while we climbed the ridges. Anyone who has taken the mountains to his heart will understand why we stopped to admire a clump of blue Polemonium in a rocky niche and a pale yellow Arctic poppy. Any mountaineer will know why we lingered with a brood of white-tailed ptarmigan, watched

Matthew Kalmenoff

By

Olaus J. Murie

them picking at the sparse vegetation. These are the true mountain grouse, braving the rigors of the highest places, as high as the vegetation will grow. White mountain sheep were all about us, dotting the green slopes as they had been doing since the glacial age. We saw the wheatear on these heights and the snow bunting, and we were alert for any chance grizzly. We knew there were foxes in these mountains, and we saw the deeply worn migration trails of caribou. A golden eagle was soaring high over the divide.

We had hunted mountain sheep in other parts of Alaska; we had shot caribou for meat and for museum specimens. But here in the highlands that had been declared a National Park, we had no desire to hunt. We sat down on a ridge and looked over a band of mountain sheep with our glasses. It didn't occur to us that we ought to have a gun. Here we were not looking at game animals. These creatures were part of a fascinating assemblage of animal life that was the product of the complex forces that shaped these mountains. The soil, climate, and the ecological influences had apportioned these animals and plants to their chosen living places and set them upon their various destinies. This area, by its special dedication, was no longer merely a hunting field. It had become a place for reflection and study, a place for wonderment and inspiration, a place where human beings, pursuing their own obscure and confused destiny, might come for refreshment of spirit and clarity of thought.

I believe it is significant that the man whose enthusiasm had so much to do with the establishment of this park was Charles Sheldon, a combination of hunter and naturalist. Moreover, the first superintendent of the park was H. P. Karstens, a woodsman and hunter who had been Sheldon's capable guide and friend and who had guided the first ascent of Denali. As superintendent he was as zealous in furthering complete protection of wildlife in the new park as he had been successful in hunting elsewhere.

These two men were big enough to distinguish one purpose from another, broad enough in interests to realize more than a single value in the out-of-doors. They were happy to give sanctuary to wildlife in chosen areas devoted to a policy different from the general one of hunting. Thus it came about that hunting became unconditionally prohibited within the boundaries that delineate Mt. McKinley National Park.

This policy has been an integral part of the National Park Service since it was established. It has been accepted and understood. The millions of people who visit the Parks each year do so without apprehension. Everyone else there, like themselves, is interested in enjoying the majesty of the natural world, and they roam the trails without fear of being mistaken for a grizzly by a man who wants to kill grizzlies.

But in recent years there have

been some threats to this policy. An occasional resolution, requesting hunting in National Parks, has emerged from sportsmen's groups. None of these requests, however, succeeded in altering the law until 1950, when Public Law 787 became effective.

In northwestern Wyoming lies a valley that had become notorious for a long-feuding controversy—the location of Grand Teton National Park and the Jackson Hole National Monument. This valley and its bordering mountains has as fair an aspect of natural loveliness as any place one can find. Here mankind can come to free the mind of entangling conflicts that corrode judgment; a place of wild slopes leading upward to heights of grandeur, to lofty displays of wildflowers, to the rare atmosphere of the domain of the rosy finch, the cony, and the brilliant red primrose. Up some of the canyons you come across an occasional moose. If you are lucky, you may see a marten along the trail or in the slide-rock.

In the valley itself you see a stimulating sweep of country — broad, flat sagelands where pronghorn and bison once came to graze in summer. At the series of lakes along the base of the mountains, moose wallow around, ducking for aquatic plants. Beaver are here and yellow pond lilies.

Here again Nature had provided a superlative spot for the enrichment of human lives. And here had centered the human argument over the spoils.

Public Law 787 was designed to settle this fight, by combining the two designated areas into one enlarged Grand Teton National Park. This was a credit to the sponsoring Wyoming Senators and to the people of Wyoming who were willing to come to agreement.

But the law contains a provision that, should it become necessary to reduce the elk herd, or at least that portion of it that migrates across certain Park lands, some shooting could be authorized within Park boundaries by persons holding a state hunting license, if deputized as temporary rangers.

It was obvious that Senators O'Mahoney and Hunt, who prepared the bill, did not wish to have this construed as a precedent for hunting in National Parks, and they said as much.

Many were concerned over the provision, however. A legislator may declare his intention that an act shall not be a precedent. But precedents are not necessarily created or prevented by fiat. They become precedents in the minds of people. Apparently that is what happened. No sooner had this act passed Congress than a spokesman for the Colorado Game Department expressed the hopeful opinion that it might lead to opening National Parks to hunting. Articles to the same effect began to appear in certain sportsmen's magazines. Some people in western Washington began agitation for hunting in Olympic National Park.

We are here faced with procedures that have crept into our method of establishing policy. If our way of life shall rest on justice, we cannot ignore certain dangers arising out of our own imperfect natures. As a people, we still countenance the filibuster and the rider on bills in Congress. In the case of Public Law 787, we have an instance of certain individuals taking advantage of the wording of a bill, contrary to the known objective of that bill. Whatever the merit of hunting in National Parks, such a change in long-established public policy should never be accomplished by indirection, on the tail of a piece of legislation designed for other purposes. It should not be accomplished by clever manipulation or by high pressure means that don't allow the interested public to realize fully what is implied.

We should examine this, or any other question, from the standpoint of the government system in which we profess to believe. Perhaps what we need today is to redefine this system. Perhaps it is allied to sportsmanship at its best. Perhaps it is allied to simple consideration and honesty.

Let us say that in the matter of hunting in National Parks, there are two groups of citizens interested, pro and con. Suppose that the decision goes in such a way that one group is given complete satisfaction, the other group loses completely and retains *no* area in which conditions remain as they wish them. In other words, the winner takes all, the loser gets nothing.

Now suppose the decision goes in such a way that both groups get their respective policies applied to different territories. In other words, neither group loses. Both groups share.

Which of the decisions would seem to harmonize with the spirit of the system we profess to believe in? Which is in line with the sportsmanship that the hunting fraternity professes to support? Which is *just?*

It is worth giving our attention to this principle. Let's see how it works out. As it concerns the animal life, there are two types of country owned by all the people. If for the present study we simplify the matter, let us say that these consist of National Forests and public domain on the one hand, and National Parks and National Monuments on the other. The first category is open to hunting, the second is not.

Now compare the extent of these two categories. The National Parks and Monuments are a minute fraction of the remaining public land. What would it be? A fraction of one per cent? Two per cent? I do not know, but certainly it is small. In other words, hunters have the opportunity to shoot practically all over the North American continent, in every state of the Union, including Alaska; on public and on much of the private land.

Here are some of the other advantages given to the shooters. A federal bureau, supported by all the taxpayers at tremendous expense, maintains a great system of wildlife refuges to counteract the killing of wildlife by shooters. The major research of this bureau is applied directly or indirectly to management of game, of special benefit to the sportsmen. Only recently, this bureau has inaugurated

a program of scouring the world to find exotic species of game birds to put into the American countryside as targets for sportsmen. The nonshooters had nothing to say about this, were not asked, though many of them would have had strong opinions on the matter.

Each state has some form of Game Commission whose sole aim is to maintain game for shooters. These commissions are supported by the shooters, and all land use and wildlife management under the commission's jurisdiction is directed primarily in the interest of the shooter. Nonshooters are almost invariably barred from participation in the administration of wildlife, though theoretically the wildlife belongs to all.

Furthermore, practically all other public agencies having to do with public land use spend considerable time on the matter of game production. I am not intimating that we should not have the federal bureaus or the game commissions. They should have our support. But in view of all this, can it be said that the shooters of America are not getting their full share of wildlife use? It is hard to understand how certain organized groups can, with a conscience, demand entry as shooters into the few land parcels dedicated to a different purpose.

This is not a brief against hunting and fishing. Nor should it be implied that all shooters are unfair. A great many supporters of the National Park policy buy hunting and fishing licenses. I have cited Charles Sheldon as a high type of sportsman who had an eye for the total public good. The late Stewart Edward White was another. The Boone and Crockett Club sponsors a system of evaluating sportsmen's trophies. But they have also undertaken to restore the desert bighorn in Big Bend National Park of Texas. It is this kind of vision and broad interest that will help to keep our field sports from degenerating into mere sadism. It will be such men who will help keep our government system from degenerating into a mere free-for-all.

Let us refer briefly to the situation on the Olympic Peninsula. Here is a National Park of the highest caliber. The virgin timber of the coastal region of Washington will, of course, disappear as lumber. When the virgin timberlands have been exhausted, the glory of the Olympic Park forest will shine with greater significance. It will then be all the more a treasure because of the scarcity of such natural forest.

If sportsmen of the Olympic Peninsula want more elk, they would do well to explore the possibility of re-establishing more extensive herds in the cut-over lowlands outside the National Park, where browse is abundant. Elk transplants are entirely feasible if attention is given to biological principles, migration habits, homing instincts, and the over-all pattern of elk behavior.

If such a program could be authorized to promote the restoration of game for the sportsman in surrounding National Forest areas—a program, co-operating with the National Park Service in its program of complete sanctuary within Park boundaries—, a harmonious situation would be created. Shooters could then have their sport in accessible areas outside, on National Forest or private lands, in areas as extensive as the wildlife authorities care to make them. And in addition to their sport, the shooters could, if they chose, join the nonshooters in the enjoyment of the unchanged wilderness of a superlative National Park, with cameras instead of firearms, or simply with the purpose of seeking the inspiration inherent in the grandeur of a mighty forest and mountain terrain. We must ever remember that when we are through taking the original "cream" of our timber supply, there will never again be the giant tree growth that is being saved in our Parks. Forest cropland policy would never permit the giant growths we now have.

Within the forest fastness of this great Park, the cougar and bobcat, persecuted elsewhere, may be given this limited chance to survive. The cougar is disappearing from the American scene. Being the counterpart of the lion in Kruger National Park of Africa, it, too, eventually will be valued as the primeval heritage of a continent. The blacktail deer, the Roosevelt elk, the fisher (if any remain), the blue grouse, mountain beaver, the irrepressible winter wren, and the varied thrush are all associated with that typical coastal forest of hemlock, fir, and spruce. Evening grosbeaks in the vine maples, a black bear on a high trail; sunlight filtering through the massive trees of the deep forest, the free openness of the high meadows, a climb on the central mountain; and over all of it the breath-taking wildness.

This is what a National Park has to offer. This is a unit we have inherited, and its value increases with each generation. We must tamper with it as little as possible.

It would seem worthy of mankind, historically so cruel in many ways, to here permit himself the luxury of generosity, by providing sanctuary for at least a remnant of persecuted animals. This is a noble gesture that man can make—a truce with our wildlife neighbors on a few selected pieces of neutral ground.

This is the feeling that moves people who support our National Park system and its wildlife policy. They have satisfaction from the knowledge that here, in a National Park, animals are permitted to live their lives with the least possible interference by man.

The Perfect Parasite—

THE VIRUS

Important progress in human medicine may result from investigation of the agencies causing tumors in plants

By Joseph Bernstein

IT is in the autumn that the disease usually strikes. During the long drowsy days of summer the sleek hogs have been contentedly fattening themselves and seem to be in sound health. But with the yellowing of the leaves and the first chill winds of fall, some of the animals become listless and no longer dine so heartily. Their temperature rises, and the farmer listens anxiously to their labored breathing. A day or so later, many of the beasts are stretched out stiff in death, victims of swine influenza.

As happens so often in the history of science, a search for one thing led to another. The bizarre chain of relationships that culminates in swine influenza was unmasked only as a result of an investigation into hog cholera. Back in the late 1930's, Dr. Richard E. Shope, who was then working at the Rockefeller Institute for Medical Research at Princeton, New Jersey, was trying to find the intermediate host that transmitted the virus responsible for hog cholera. He had heard of a popular belief among the farmers in the Middle West that the outbreaks of hog cholera had something to do with the hogs eating earthworms.

Now earthworms are also the hosts for certain tiny juvenile roundworms that spend their mature lives in the lungs of swine. And the inspiration struck Dr. Shope that these little lungworms might provide the basic clue to hog cholera. Later events showed this hope to be unfounded. But through a series of highly ingenious experiments, Dr. Shope succeeded in unraveling the mystery of swine influenza.

The swine lungworm lives a double life, which seems most peculiar to anyone who doesn't know parasitic worms. Its early stages are spent in the calciferous glands and other organs of the earthworm, and the rest of its existence in the bodies of pigs. The goal of every young lungworm is the lungs of these animals. One might think, therefore, that the natural and easy thing for it to do would be to proceed directly to these organs. This, however, the lungworm does not do. To reach its destination it travels through a fantastically circuitous route.

The journey actually begins in the lungs of the pig, where the adult female lungworms have deposited their eggs. These are coughed up, swallowed, and passed down the digestive tract, finally being eliminated into the soil. There the eggs are swallowed by earthworms and hatch into larvae, which find their way to the worm's heart, gizzard, and calciferous glands. Within the earthworm they molt twice and thus become "third-stage" young. Only at this stage can they infect pigs. And they can survive in this form inside an earthworm for as long as four years before being swallowed by a pig and continuing their life cycle. But swine are rather fond of earthworms, and the chance of getting

▲ Tumors on a sweet clover plant. On tumor may be seen on the lowest branch o the right where it rubbed against the edg into the digestive tract of one of them is very good.

Once liberated in the hog's intestines, the larvae bore through the intestinal wall and proceed to the lungs, where they at last mature into adults.

There is an ancient jingle that runs as follows:

> "Great fleas have little fleas upon
> their backs to bite 'em.
> And little fleas have lesser fleas,
> And so ad infinitum."

While the author of this profound maxim of parasitology probably never heard of swine influenza, he put his finger on the basic clue to this disease. For the truth of the matter is that the lungworm, which so ingeniously uses the earthworm to "hitchhike" into the vitals of the hog, is itself invaded by a "lesser flea," so to speak, which also has the same destination. The lungworm harbors and transports the virus responsible for swine influenza.

But this virus is in a quiescent, masked stage in the lungworm. It is provoked into infective activity in swine only when these animals are exposed to various types of stress, such as the presence of other microorganisms.

So extremely small is this virus that it cannot be seen with the ordinary microscope. It passes with ease through the finest filters that can prevent the passage of bacteria. But photographs of it have recently been made through the electron microscope, and it seems to have a fascinating variety of shapes. The images range in form from circular to oval and elliptical. Many even have a beanlike appearance, and on occasion they become filaments.

Just what this bewildering confusion of shapes may mean is anybody's guess for the present. Perhaps they represent different stages of an elaborate cycle of development such as occurs among organisms higher up in the scale of life.

Of course, we cannot attribute wisdom and knowledge to something as primitive as a virus. But there can be no question that the swine influenza virus thrives by virtue of the fact that hogs feed on earthworms and that lungworms parasitize both hogs and earthworms.

But a virus does not necessarily have to utilize only animal agents to achieve its goal of self-perpetuation. This becomes spectacularly apparent in the strange relationships involved in the origin of certain abnormal growths in plants.

Anyone walking through a meadow or field has undoubtedly seen certain small squat, triangular insects popping explosively about in grass and foliage. They are most appropriately called leaf hoppers, and their agile leaping from plant to plant is associated with the serious business of getting a living. The mouth parts of these insects are slender, jointed beaks—admirably suited to the job of piercing the plant's tissues and sucking the

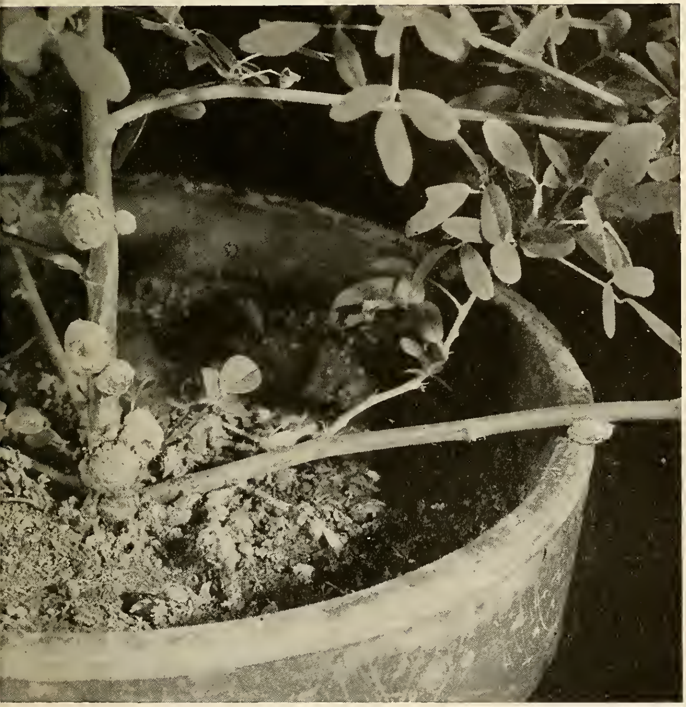


Photo by Julian Carlile

of the pot. A virus is the actual cause of the tumors, but an insect known as a leaf hopper conveys the virus to the plant. Every effort to inoculate the plant with the virus artificially has failed; only the leaf hopper can do it

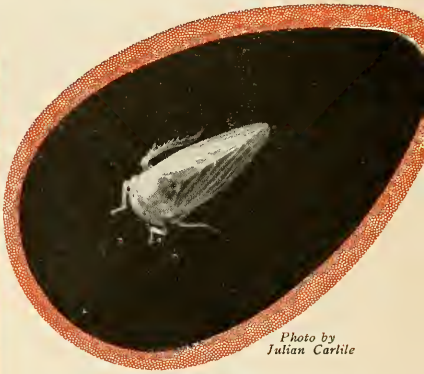


Photo by Julian Carlile

▲ AN ENLARGED photograph of the leaf hopper *Agallia constricta*—one of the kinds that transmit wound-tumor virus

Brooklyn Botanic Garden photo

▲ **Dr. L. M. Black** working on the wound-tumor problem in the greenhouse at the Brooklyn Botanic Garden

▼ ALTHOUGH ONLY THE LEAF HOPPER can infect the plant, a laboratory technician can convey the virus from a diseased plant into the insect's body and make it thus a carrier. This picture shows that process. After an incubation period of two or more weeks, the insect will be able to infect healthy plants

juices, which make up the leaf hopper's diet.

But leaf hoppers do not confine their activity to the relatively innocent one of extracting a small amount of juice from a plant. The plant can well spare the infinitesimal amount of sap taken by this insect. Certain leaf hoppers have another role to play—an involuntary one from which they derive no benefit.

For a few weeks after visits of these particular leaf hoppers, nothing is seemingly wrong with the plants. Then a most peculiar transformation takes place. Depending on the species, tumors of various sizes may appear on the roots and stem. The veins on the undersides of the leaves may become enlarged in an irregular fashion; the leaves may curl, the stem thicken, and flowering may be suppressed. The growth of the entire plant may be stunted. The plant looks and is quite sick.

Although exhaustive efforts have been made to detect it, no one has yet seen the agent responsible for this disease. Not even the powerful electron microscope in the hands of a leading worker in this field, Dr. R. W. G. Wyckoff, has given any inkling as to its appearance. On one thing there is complete agreement, however—the causal agent is a virus.

Known as the wound-tumor virus, it was first discovered by Dr. L. M. Black in 1944 at the Rockefeller Institute for Medical Research, Princeton, New Jersey. It is right now still under intensive study by Dr. Black and his associates, Dr. M. K. Brakke and Dr. L. G. Nickell, at the Brooklyn Botanic Garden.

While the wound-tumor virus can infect a large variety of plants, the investigators at the Brooklyn Botanic Garden have been studying its effects on two lowly plants, sweet clover and sorrel. These plants are of little economic importance and do not have any aesthetic features that might distinguish them. Sweet clover, as a matter of fact, is often annoyingly common in fields and neglected gardens. But both plants can be grown with great ease and convenience under laboratory conditions and have the added value of responding to the virus by producing conspicuous tumors on the stems and roots.

One of the mysterious things that was early discovered about the wound-tumor virus was its fastidious insistence on being introduced into the plant in a certain manner. Like practically all leaf hopper-borne viruses, it must find its way into the plant's tissues by means of the mouth parts of a specific insect. No other way will do.

All sorts of tricks have been tried to circumvent this peculiar insistence of the virus on leaf hopper transport, but all have failed. For example, you just can't mash up a number of infected leaf hoppers, inject the mixture into healthy plants, and expect to get tumors on the stems and roots.

Nor can you inject the sap from diseased plants into uninfected specimens and produce the disease. It is true that most other plant virus infections can be caused this way—but not wound-tumor. As a matter of fact, diseased and healthy plants can be grown together, side by side, and if leaf hoppers are not around, the healthy plants will not develop tumors.

But the picture is strikingly different when it comes to infecting the leaf hopper. A fine glass tube containing some of the juice from a diseased plant will readily introduce the virus into the insect's

➤ **Dr. L. M. Black** uses a fine glass tube to inject into the insect's body some of the juice from a diseased plant. There the virus particles will increase in number. Healthy plants can grow unharmed beside unhealthy ones if the leaf hopper is not present

Photo M. Bassity

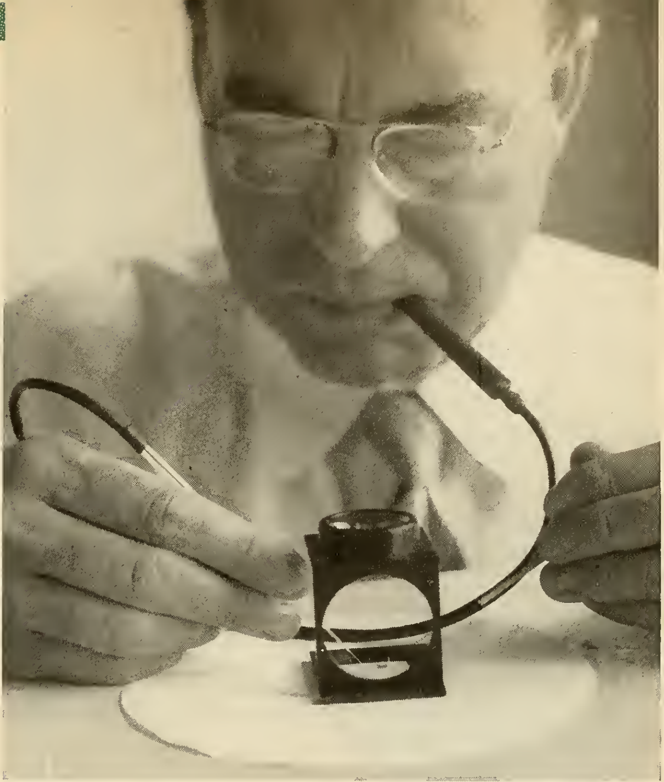


Photo M. Bassity

body. There the virus particles will increase in number, and the leaf hopper will now be able to spread the infection to healthy plants. In the normal course of events, however, the leaf hopper first acquires the virus by sucking it into its body with the juices from infected plants.

Once the insect has become infected, it cannot immediately proceed to introduce the virus into plants. The virus requires a period of incubation in the insect host. An interval of two or more weeks must elapse before healthy plants can be inoculated successfully. And the plant will first show the signs of infection three weeks later. But once the leaf hopper is capable of infecting plants, it can transmit the virus to new specimens every day or at other intervals for quite a long time, possibly until it at last dies of old age.

Now, what happens to the insect harboring the virus? Does it show any physical signs of being parasitized or of being indisposed in any manner? Close scrutiny of infected leaf hoppers has failed to indicate that they look or act differently from those known to be free from the virus. This, of course, does not mean that the insects may not be actually suffering from some obscure disturbance of body function that may not be readily obvious.

On the other hand, it may be to the advantage of the virus not to kill the insect. It may be that the ultimate goal of this virus is the tissue of plants, so that it would be necessary to its survival to have healthy leaf hoppers actively engaged in spreading it to new plants. The sparing of the leaf hopper from the ravages of disease may thus be an adaptation through which the virus derives the benefit later on. In this respect it is rather significant that the wound-tumor virus, like most other leaf hopper-carried viruses, is not transmitted from the infected female insect to her eggs. It would almost appear from this that the virus is avoiding interfering with the delicate processes of embryonic development. Such an intrusion might possibly curtail the production of healthy crops of young leaf hoppers that would later be needed for the all-important job of spreading the virus to new areas.

A similar scrupulousness seems to exist with regard to the infected plant. Only a few plant viruses are known to pass into the seeds. Wound-tumor virus is one of the majority that do not. Does this not seem akin to the fattening of a victim for the inevitable kill? Obviously the virus can do a better job of propagating itself in a mature plant than in a puny seedling.

We must not assume, of course, that there is anything even remotely suggesting design on the part of the virus. Such romantic speculation on the part of naturalists has long been discarded as fruitless in the interpretation of how organisms respond to their environment. But the activities of the virus do reflect a remarkable series of interlocking adaptations geared to self-perpetuation — adaptations that would do credit to a higher organism. The scientists who study evolution know that it takes a very long time for a species to perfect a highly polished and delicately adjusted adaptation. This shows that the virus, far from being a newcomer on the scene, has been around for a long time.

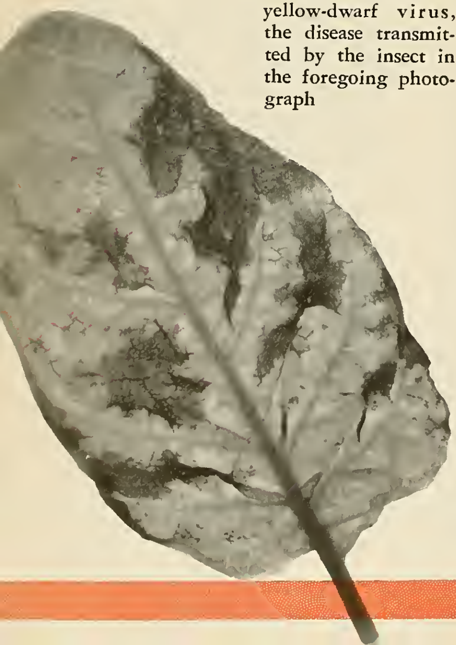
There is something unusual, too, about the tumors that appear on the diseased plants. These growths are frequently associated with a wound or injury to the tissues. In the roots, for example, they develop at the sites where new rootlets push through the tissues to reach the soil outside. This phenomenon was demonstrated by an experiment by Dr. Black. Infected sweet clover plants were pierced at various points along the stem with insect pins. At most of these spots tumors developed.

Now, it has long been known that injuries to animal and human tissues may produce cancerous growths. Viruses have also been implicated in a number of different types of tumors in animals, particularly in rabbits and poultry. Plant tumors, of course, are not the same as animal cancers. They do not, for example, spread from one growth site throughout the body of the organism.

But it may well be that a virus-injury relationship may be found to play an important role in the origin of certain abnormal growths in humans and animals. Dr. Black has already pointed out the startling resemblance that the wound-tumor virus of plants bears to the virus responsible for breast cancer of mice. The significance of the wound-tumor virus work has not been missed by authorities on cancer, for the American Cancer Society has contributed financial support for the research at the Brooklyn Botanic Garden.

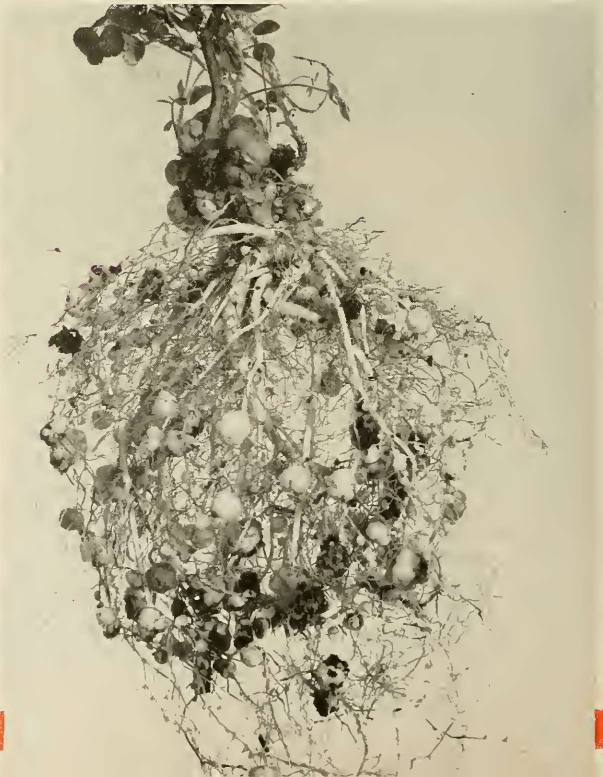
Depending on the species of plant, the tumors may vary from pustules to fairly large spheres that may cover the entire root and be firm and woody in texture. As the tumor first develops, it seems that it is trying to produce normal tissues. But this effort at normality lasts for only a short while. Soon

▲ PORTRAIT of a clover leaf hopper responsible for transmitting potato yellow-dwarf virus into plants. This virus produces severe destruction but without tumors.



▼ A VICTIM of a severe strain of potato yellow-dwarf virus, the disease transmitted by the insect in the foregoing photograph

▼ ROOTS of a sweet clover plant badly infected with wound-tumor virus. The round growths are tumors



Photos by J. A. Carlile

the struggle is given up, and the insidious process of degeneration takes over, with the cells taking on an irregular shape.

If tiny chunks of tumor are successively grafted to healthy plants, they can grow indefinitely. Likewise these pieces of abnormal tissue will thrive heartily in various synthetic media containing salts and organic compounds. Dr. L. G. Nickell has been studying the nutritional needs of isolated groups of tumor cells, and his findings are not only important to understanding the pathology of plant tissues. They may also clarify many of the secrets of normal plant growth and development.

But let's take a more searching look at the agents to which the wound-tumor virus belongs. The viruses are responsible for disastrous illnesses among humans, animals, and plants. But scientists have not been at all certain as to just what they are. Not so long ago they were commonly considered as complex molecules, made up mainly of nucleoproteins. It was suggested that they occupied a mysterious "no man's land" between dead organic matter and the most primitive living organisms. Few wanted to dignify them with the actual title of "organism," however.

There was considerable favorable opinion about their being the first primitive substances from which cells evolved on this planet. Some scientists even suggested that they were hereditary particles divested of the usual cellular apparatus—genes in a state of isolation.

Strong support for such an idea came from the dramatic discovery several years ago by Dr. Wendell M. Stanley that the virus responsible for mosaic disease of tobacco plants could actually be isolated in the form of crystals. Added to this was the fact that viruses did not appear to have all the characteristics that have always been associated with living organisms. At best, the virus was perhaps envisioned as a molecule just on the verge of being alive—but not quite.

But as investigators probed deeper into the problem, they found some disturbing exceptions to these attractive theories. For example, some viruses, such as those living inside bacteria (another instance, by the way, of "little fleas having lesser fleas") have a tadpole shape, with a tail-like structure sticking out from one end. Some of these bacterial parasites even have membranes like those of microorganisms. The view of some authorities that viruses are true organisms has been strengthened by these observations as well as by other evidence.

There is one thing that is true of every virus—it is always a parasite. No one has ever discovered a free-living virus. But viruses are highly special parasites. They can increase themselves only inside the cells of living organisms.

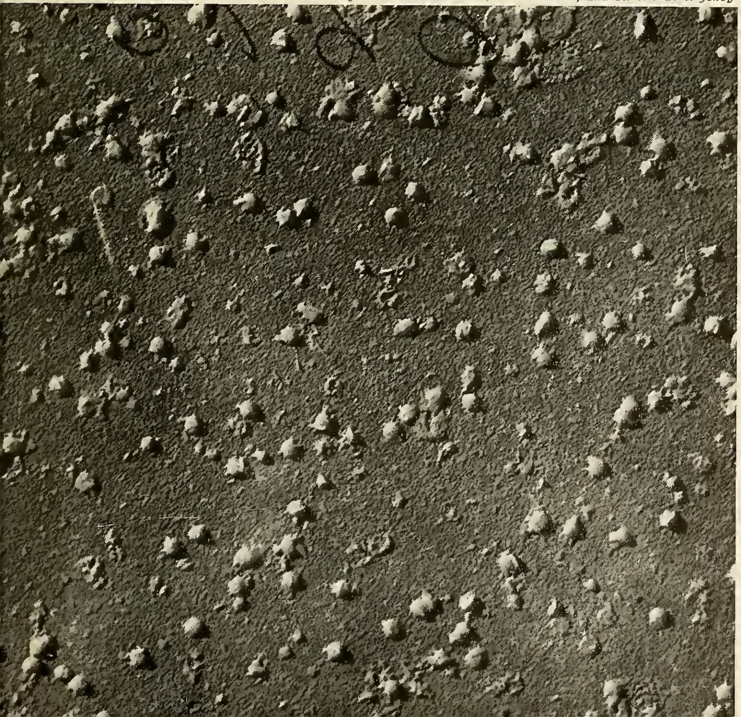
Parasitic organisms, in general, have perfected an elaborate array of tricks for eking out an easy existence at the expense of their more or less unfortunate hosts. And the more adept a parasite becomes in such a slothful way of living, the less use it has for certain organs ordinarily very useful in the hurly-burly business of trying to stay alive. Animal parasites can dispense with their sense organs and a good portion of their nervous systems. Muscles and the other apparatus for locomotion often atrophy and disappear. The parasite eventually deteriorates into a highly specialized reproductive machine for producing young.

In plants, there is the loss of the chlorophyll, which the parasite no longer needs to manufacture its food. There is also the perfection of organs for attachment to the host as well as those required for reproduction. Here, too, the parasite dispenses with as much as it possibly can.

How far can this process of degeneration go in a parasite with the organism still remaining an organism? The answer may well be the

▼ **The villain** of the piece, long invisible to the sharpest scientific eyes: potato yellow-dwarf virus as seen by the electron microscope. Each of the larger raised white particles is a virus. This is the largest plant virus known and the only leaf hopper-transmitted one ever photographed. Viruses have also been implicated in a number of different types of tumors in animals

Photo by Drs. M. K. Brakke, L. M. Black, and R. W. G. Wyckoff



virus—the ultimate parasite. It has literally done away with everything not absolutely essential to reproducing itself. What this means is that nearly everything that scientists have come to consider as fundamental to cells has been dispensed with as so much excess baggage. And in the course of such retrograde evolution, the virus has at last become reduced to a particle that is no longer protoplasm, as commonly understood. Its only function has become the process of converting the protoplasm of its host into more and more particles like itself. As we have seen in the cases of swine influenza and wound-tumor of plants, viruses may go through elaborately roundabout byways to perpetuate their kind.

A cynic might perhaps remark that such ingenuity at exploiting other organisms might better have been expended in achieving a free and independent existence. But such moral judgments, derived from a purely human standard of ethical conduct, have little or no meaning in nature, where the basic rule is to try to survive. From this standpoint, the virus may be considered a uniquely successful organism. Stripped down to the bare chemical essentials for maintaining itself as an entity, it has adapted itself in an astounding way to the habits of other organisms in order to insure its survival.

It would take us too far afield to attempt to explore the large number of serious virus diseases afflicting man, valuable domestic animals, and important economic plants. Suffice it to mention that in recent years the cattle-raising industry of Mexico has been almost completely demoralized by the wildfire-like spread of hoof-and-mouth disease. The threat of the possible invasion of this dread virus infection into our own country almost created a panic in our cattle industry, and our Government poured large sums of money into Mexico to aid in the fight against the virus.

Also in the last few years, the American people have watched with helpless horror the deadly and crippling blows struck by another virus—that responsible for infantile paralysis. And it was not too long ago that New York City mobilized all its resources in a mighty mass effort to immunize its vast population against another virus-caused plague, smallpox.

Who knows but that the findings on the humble sweet clover and sorrel may provide a basic clue to coping with our most formidable virus foes?

But the virus also presents a different sort of fascination. It is something that must confound a man-made system of morals. For we are here confronted with the supreme success of complete degeneracy. The virus represents the very last stage of retrogression in what once may have been, on our terms, a full-fledged and respectably independent organism. It is the consummate parasite, the most accomplished in its nefarious art. All other kinds of parasites are merely clumsy imitators of the virus's refined technique in robbing a host.

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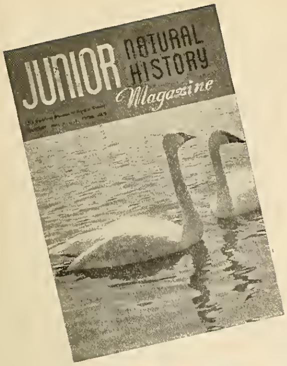

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BOOKS

Continued from page 439

Since the end of the eighteenth century the world population has continued to increase until it is now several fold greater than it was in Malthus' time. This was possible in part through unforeseen technological advances which have produced a considerable increase in food production, but with an intensification of population pressure in a number of danger spots throughout the world. The fact that this increase was possible at all has blunted for many students the urgency of Malthus' principle. Only recently serious thinkers have once again become alarmed by the critical situation of a constantly increasing tempo of population growth with no proportionate addition in food supply in sight. Hardly 10 per cent of the land surface is suitable for efficient agriculture, and experts can see only moderate increases in yields, yet the world's population is likely to double in 75 years if it follows present trends. Much of this unbalance has arisen from the fact that while modern medicine has reduced the death rate drastically, the birth rate has not dropped in equal degree, and in some parts of the world has remained at high levels.

Mr. Cook, passionately concerned about this trend, has written an equally passionate book about it. But he goes further than this aspect of the problem, serious as it is. He is equally concerned about those countries of Western Europe and particularly the United States where contraception has become an effective method of controlling the birth rate. In these countries restriction of the birth rate appears to have become disproportionate in its distribution through the social structure. The situation has already arisen in the United States where a large part of its population replacement is coming from the most depressed agricultural areas of the country. The loss in quality that this course might bring about Mr. Cook calls "gene erosion." In his view it represents a dangerous trend that must be corrected by a general recognition of its utmost seriousness for our future national well being.

Mr. Cook has written an important book, full of zeal and pungent in style. It is a book that anyone can follow without specialized knowledge. Although I cannot accept all his premises and conclusions, I must admit that the necessity that we do a little serious thinking about these problems is so overriding that any book which serves that purpose must be received gladly and with joy.

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Continued from page 445

and picked our way with the same caution. In time its canyon opened into a second valley, larger but desolate and treacherous like the first. Here were more of the hissing vents and fumaroles, but at the far end loomed a U-shaped portal, flanked by high cliffs of smudgy black. From this arose clouds of steam in a continuous roar.

This was the place, and we viewed the famous lake. Picture a ring of high dark cliffs, devoid of plant or animal life. At their base is a narrow terrace of yellow mud, overlaid with a thin crust. This lips the lake. As for the latter, consider a stewpot. A large one may be a foot across, and the bubbles of steam breaking upon its surface may reach an inch in diameter. Our Dominican stewpot is 100 yards across, and the boiling bubbles are 30 feet or more in size. At first, one can see almost nothing, so dense is the sulphurous steam. Then a gust of wind tears the cloud away, and one sees black waters flecked with foam, on which these enormous bubbles rise and break.

Whup, whup, whup! First here, then there, these giant bubbles rise and burst, and sometimes, it is known, a superbubble almost the diameter of the whole lake rises to explode on contact with the air. Then, for the fraction of a second, the entire surface of the lake is like the convex crystal of a watch.

At such times, generally when the water level is below the average, this lake can be deadly, for poisonous fumes can rise and kill those near by. However, Cyril considered the water level safe, and with confidence I descended a slope to stand within ten feet of the boiling waters. A mist covered me, the smell of sulphur was strong, and I was warned not to approach too closely, lest the bank cave in and drop me to a quick death. For so a man had died. And two men had quickly died from fumes on the same spot at which I stood.

One does not remain long near the border of this lake. At first one feels wonder, but as the minutes pass, this gives way to a sense of evil and menace. "*Mais pourtant, c'est vraiment la bouche d'enfer,*" a French priest had said as he stared upon this pit. "The mouth of hell," and his words were apt, for the black cliffs rise like the walls of a dungeon, the earth is blasted and sickly looking, the sky is overcast with gloomy nimbus, and the boiling lake bears witness to fires not far beneath the treacherous crust.

On our way back, Cyril related the tragedy of the Clive party, of Mr. Clive the English traveler who made this trip to the lake with two guides some 25 years before. They came to the edge while the lake was boiling more furiously than usual, and Clive climbed one of the surrounding cliffs to take pictures. In the meantime, the two guides—one was named Wiley and the other Rowle (Cyril's grandfather)—approached the lip, at the same spot where I had stood. Suddenly, an enormous bubble, which all but covered the entire lake, rose, swelled so that its convex center stood ten feet above the rim, then broke into foam, releasing its gases into the air. The wind blew toward the guides.

Wiley fell where he stood, never to move again. Rowle, who happened to stoop down in a slight declivity where a rivulet sought the lake, escaped the worst of the gas cloud, but he felt a dreadful nausea. Clive scrambled down and stood beside him.

From Rowle's account, Clive refused to believe that Wiley was dead. He tried to revive him with brandy, while Rowle pleaded with him to leave the spot before another bubble should come. However, Clive could not grasp the danger, and belittling the warning, he ordered Rowle to return to Laudat for medical aid.

So bidden, Rowle left, and the last time he saw Clive alive, the Englishman was standing with his back against a bank, gazing down on Wiley. When, hours later, Rowle returned with the rescue party, Clive was still in the same position, looking down at the prostrate guide. Clive's eyes were open but saw nothing. He was dead, and so was Wiley. The bubble of death had risen and burst once more while Rowle was gone.

Such was Cyril's vivid story, which he had received directly from his grandfather. Since that day the boiling lake has claimed one more victim—an uncle of Cyril's. Circling the rim, he ventured too near. The bank gave way and carried him with it. He fell in only to his waist and managed to scramble back, but he was carried home in great pain; the flesh came off the scalded parts, and he died shortly.

One more thing Cyril mentioned. The temperature of this lake has been taken, and it is 219 degrees F. Since the elevation is a good 2000 feet or more above sea level, the sulphur and other minerals must cause a rise in the boiling point.

With such talk, we started our return, and at length stood once more on the summit of Morne Nicoll, with the desolate inferno far below. Now, a singular occurrence took place. As we had traversed the regions of the great pit, there had been no sign of bird or beast in all that mile-long valley. If one had been a superstitious native like those in the tiny interior villages, he would say that the valley was but a place for the revels of witches, demons, zombies, and *soucouyants*, a Dominican version of the summit of the Hartz Mountains on Allhallows Eve. It was no place to linger. Now we were out of it.

Suddenly the sun, which had been obscured all day, burst through the clouds, and a wide patch of blue sky made a cheerful appearance. We stood enjoying the warm rays, when from some hidden spot near by there arose, high, sweet, and clear, like the notes from a flute, the call of a bird. It was the song of the Siffleur Montagne, the famed songster of these jungles. It was like an all-clear signal—a sign that we were free from the dangers of the region of the Boiling Lake.